Railway Mechanical Engineer

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Table of Contents

EDITORIALS:

More locomotive maintenance needed..... 1
Mill room equipment and operation..... 1
Why use inefficient boilers?..... 2
The machine tool outlook..... 2
Take up the lost motion..... 3
New books..... 3

WHAT OUR READERS THINK:

Finding amount of wear in main rod brasses..... 4
A word in favor of charcoal iron..... 4

GENERAL:

Ramsay turbo-electric locomotive..... 5
Gasoline car with independent power units.....11
Bureau of Locomotive Inspection report.....14
Derailments of locomotives on curves.....16
New Santa Fe locomotives for the C. N.....20
Motor car of large capacity.....21

CAR DEPARTMENT:

Improving car department service.....24
Renovating interior trimmings of passenger cars.....30
Decisions of the Arbitration Committee.....33
Car and engine replacer clamp.....34
New type milk cars for the Lehigh Valley.....35
Hooks, cables and chains for wrecking service.....38

SHOP PRACTICE:

Maintaining train control equipment on locomotives....39
Jig for planing the boiler radius on cylinder saddles.....44
Method of applying gages to eliminate vibration.....45
Locomotive valve setting chart.....45
The year's machine tool purchases.....46
Boring bar for compound pump cylinder.....57
Superheater unit test rack.....58
Reducing valve piston repairs.....58

NEW DEVICES:

Electric butt welder with a water-cooled transformer....59
Universal truck column anchor.....60
Packing gland provides for improper alinement.....61
Roller bearing for line shaft hangers.....61
Quartering gage with vernier attachment.....62
Electric friction head screw driver.....62
Motor driven bench drill.....63
Pneumatic drill provided with a speed governor.....63
Electric hoist with low head room.....64
Hand tools adaptable to railway shops.....64
Whiting screw type electric drop table.....65
A self-contained centrifugal oil extractor.....66

GENERAL NEWS.....67

FOR THE FEBRUARY ISSUE

Analyses of the car and locomotive orders placed in 1924

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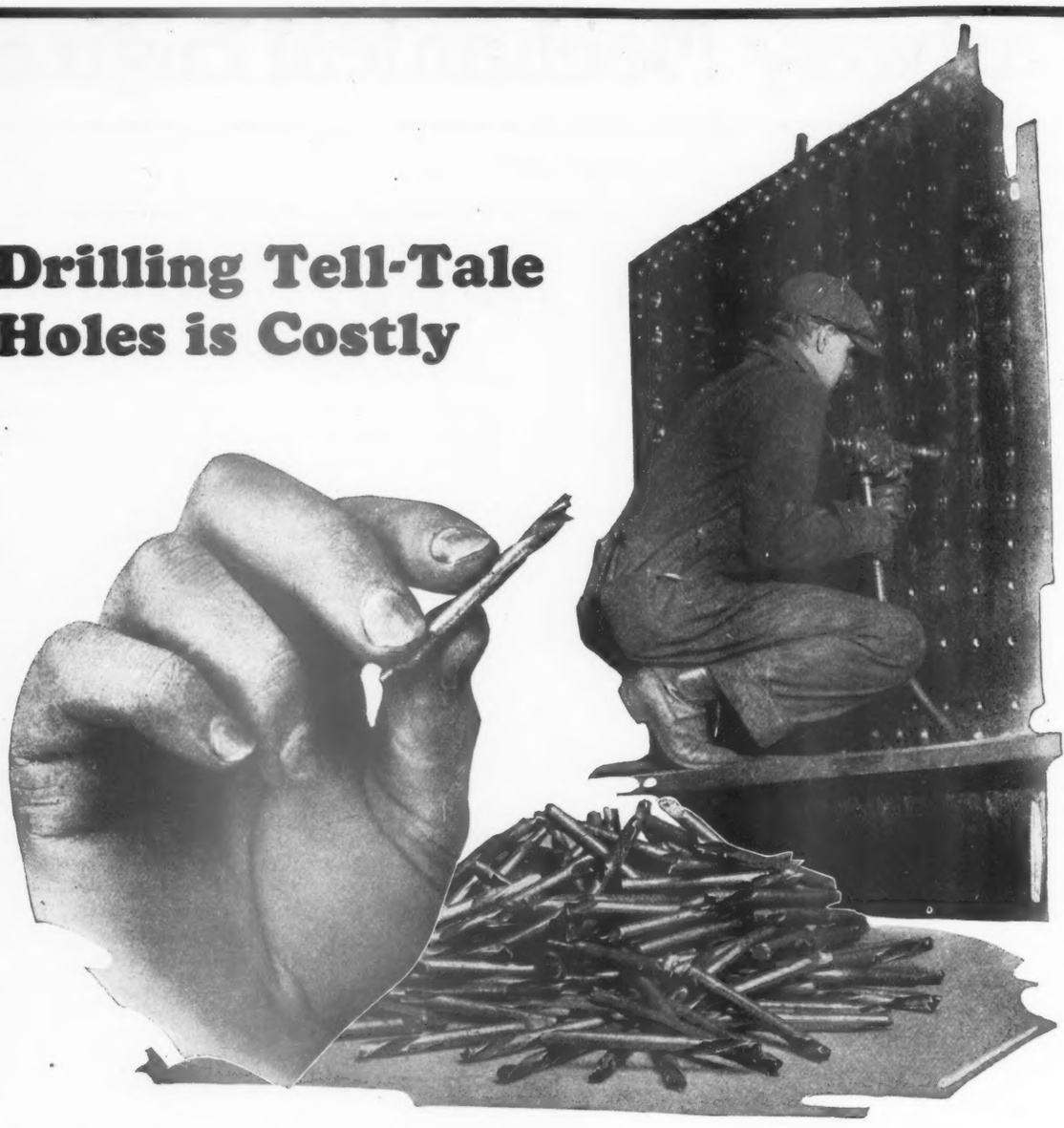
Drilling Tell-Tale Holes is Costly



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Railway Mechanical Engineer

Vol. 99 January, 1925 No. 1

Elsewhere in this issue will be found an abstract of the annual report of the chief inspector of the Bureau of Locomotive Inspection of the Interstate Commerce Commission which shows that during the fiscal year ending June 30, 1924, the commission's inspectors were compelled to order 5,764 locomotives out of service for the repair of defects which constituted violations of the law. In his report the chief inspector makes the following highly suggestive statement: "Conditions," he says, "are far from being satisfactory in so far as a proper compliance with the law is concerned. If due diligence is pursued by the carriers in seeing that locomotives are in proper condition and safe to operate before being offered for service, the commission's inspectors will not find it necessary to order any locomotives from service, which frequently causes serious inconvenience to the public as well as an added burden to the carriers."

More locomotive maintenance needed

It is evident, of course, that whether fully acceptable or not, neither the railroads nor the Bureau of Locomotive Inspection has any discretion as to observance of the rules and requirements of the Bureau, since they have the force of federal law. They are, however, generally conceded to be entirely sound and in fact represent nothing more than recognized good practice. Where conditions are permitted to develop which result in the necessity for removing locomotives from service to prevent violations of the law, it has been found that the railroads are not serving their own best interests. Entirely aside from the safety aspect of the case, with which the law is concerned, such conditions decrease the reliability of locomotives to such an extent that engine failures multiply and all of the attendant delays and expense are encountered in the conduct of transportation.

During the fiscal year ending June 30, 1924, there were considerably less locomotives out of service for repairs than during the preceding fiscal period. The number of accidents caused by failures coming within the scope of the law, however, is only about 10 per cent less than during the earlier period, and still much greater than during 1920, 1921 or 1922. This would indicate that although the number of locomotives actually reported unserviceable has been decreased, there was still much to be done in restoring a satisfactory amount of the mileage life to the locomotives in service, since many of the defects most commonly encountered are not likely to develop on power on which proper renewals and repairs have been made in the back shop. If conditions are to improve next year, then, the average number of months since shopping must be reduced. This will relieve the terminal organizations of excessive work on worn out power and make possible the current handling of such running repairs as are required.

One of the best indications available to the executive of the extent to which these ends have been accomplished will be found in the reports of its inspectors rendered periodically by the Bureau to each railroad. They should be followed closely and their indications used as a basis of action, not alone because this is required by law, but because in that way can the most economical and reliable locomotive service be obtained.

One of the important factors in car shop operation is the mill room. Owing to the fact that this particular part of the car shop usually operates smoothly, providing lumber cut to size and machined as required, it frequently receives less attention than its importance warrants. The possibilities of material and labor saving or loss, dependent upon the way lumber is handled in mill rooms, are large. Some idea of the magnitude of railroad mill room operations in the aggregate may be gained when it is realized that the railroads purchase directly about 17.5 per cent of the annual timber cut of the country. Statistics of the Bureau of Railway Economics show that in 1923 the Class I railroads purchased approximately 2,388,800,000 board feet of lumber for which they paid nearly $100,000,000. The amount mentioned does not take into consideration lumber used for cross ties, poles, posts, etc.; therefore, a large proportion of the 2,388,800,000 board feet undoubtedly is handled in railroad mill rooms.

Mill room equipment and operation

In mill room equipment one of the first essentials is an adequate supply of planers properly maintained so as to provide accurate, smooth and rapid work. The value of a four-side planer, particularly in shops which are pressed for output, can hardly be over-emphasized. This machine planes all four sides of a timber at the same time, eliminating three passes, and saving time and labor. It increases mill room and consequently car shop capacity. A full complement of saw equipment is required, including cut-off saws, self-feed rip saws, swing saws, band saws, etc. An adequate number of modern saw filing machines will assist materially in keeping these saws in the best condition for effective work. Other more or less standard tools which save labor and increase mill room efficiency and capacity are multiple spindle boring machines, jointers, mortisers, tenoners and gainers with boring attachments, multiple spindle shapers, dovetail machines, molding machines, automatic knife grinders, circular saw grinders, etc. One of the best labor saving tools in the pattern shop is the drum sander. This and other sanding machines greatly reduce the labor involved in finishing patterns and cabinet work to the required degree of smoothness.

Aside from machines of standard type many special machines have been developed by manufacturers and in some cases by railroad men which have proved effective

for such purposes as manufacturing wooden tie plugs and other similar items. When a mill room is properly equipped with modern machinery, the next essential is to arrange it so that the timber travels from one machine to the next through the shop, back travel being eliminated or reduced to a minimum. While many railroad mill rooms are now operating along the lines indicated with modern machinery and an up-to-date organization, the amount of money involved is such as to justify frequent checks to see if the most efficient operation is being secured, that needed machinery is available, that it is properly located, and that the mill room organization functions to the best advantage.

Why use inefficient boilers?

With the advent of extreme cold weather comes the realization on far too many northern railroads of the existence of a shortage of steam for heating and thawing purposes. This condition in itself is bad enough, but the remedy that is so often applied is worse. The installation of old locomotive boilers for stationary service is a practice that has very little to commend it. There is no condition, either from an operating or economical standpoint, that justifies a deliberate attempt to see how much coal can be burned in a given time and get so little from it. A locomotive boiler is an admirable steam generator when used on a locomotive with a strong induced draft, but when transferred to stationary service with natural stack draft or even mechanical forced draft, it leaves much to be desired as a means of efficient combustion. It will be argued that most installations of this kind are purely emergency ones and that the old locomotive boiler, even with its admitted inefficiency, satisfactorily meets the immediate demand because it can be quickly and cheaply put into service. The cost of operation, apparently, is not given very much consideration.

A suggestion in connection with this practice may not be entirely inappropriate at this time. A broad survey of the conditions surrounding the use of steam in yards and around engine terminals will very often disclose sources of enormous loss that are ordinarily overlooked. If proper attention is given to steam leaks at valves, hose connections, etc., as well as to the thorough lagging of all open steam lines, the present steam consumption may be materially reduced. A carefully prepared statement showing the distribution of steam uses, with particular attention to losses from leakage and radiation, will do more than any other one thing to emphasize the possibility of minimizing steam losses. If this subject is intelligently and thoroughly analyzed, the surprising discovery may be made that, by the expenditure of a comparatively small sum in proper maintenance and repairs, when the next season of cold weather approaches, the old locomotive boiler, instead of being drawn into a service where it can perform but poorly to say the least, may be consigned to the scrap pile where it belongs.

The machine tool outlook

Elsewhere in this issue appears an article on the machine tools purchased during 1924, which contains estimated expenditures on shop equipment for the coming year as well as a prediction that the budget figures given will be greatly exceeded at the end of the year. Predictions are easy to make but are far more effective if substantiated by facts. Let us see what facts there are to substantiate this forecast.

In order to purchase new equipment the railroads must first obtain the necessary capital. They have two means of doing this; first through net income and second, through the proceeds of the sale of an issue of bonds or stocks. Figures for the last four months of 1924 show that most of the railroads handled record breaking freight traffic which resulted in increased net operating income. This increase in net income was not due to a reduction in wages or taxation, or increase in freight rates, but largely through the increased efficiency of railroad operations. There is every reason to believe that this increase in traffic will continue in 1925. Since the presidential election, a steady increase of unfilled orders has been shown in the steel industry; there has been an increase of proposed construction work and a rise in the price of farm products which will increase the buying power of the farmer. These facts indicate that the railroads will be called upon to haul enormous freight tonnage during the coming year and this will ultimately result in increased net operating income.

The railroad officers have expressed optimistic views concerning freight traffic for the coming year. They are very cautious about making forecasts, but, in a series of articles by presidents of some of the leading railroads of the country published in the January 3 issue of the Railway Age they are unanimous in anticipating an increase in traffic for 1925.

It has always been much easier to raise capital with which to purchase railway equipment than for other purposes because equipment trust notes can be issued for the purchase of equipment, while practically all fixed improvements must be financed by the issuance of bonds or stocks or from net income. Therefore, the fact that the earning capacity of the railroads has been greatly improved due to increased traffic and to better operating efficiency will enable them more readily to finance permanent improvements in fixed property.

During the past year the railroads of North America have purchased 1,534 locomotives, 147,345 freight cars, 2,654 passenger cars and 130 rail motor cars according to compilations made by the Railway Age. For years the railroads have been making similar purchases of equipment and while a considerable portion of the new units is acquired to replace old units retired from service, there has been a steady increase in the number of locomotives and cars, and the replacements themselves have served to increase rapidly the average size of the units which must be maintained. This has not been accompanied by a proportionate increase in shop capacity or by the purchase of the modern machine tools required to meet the present demand for increased shop efficiency and, speaking generally, capacity to make needed repairs has long been taxed to the limit.

Railroad officers are rapidly coming to realize that much of the old machine tool equipment in the repair shops is obsolete and inefficient. An outstanding recognition of this fact is contained in the statement by L. F. Loree, president of the Delaware & Hudson, which appeared in the annual statistical number of the Railway Age, in which he said: "Perhaps the point in which railroad facilities are the weakest is in the machine tool equipment of the repair shops. The development of machine tools receives a great impetus from a war and from the growth of a new industry. During the past 15 years we have had the World War and the development of the automobile business. The effect has been to revolutionize machine tools and to render obsolete a large part of the machine tool industry."

The volume of machine tool purchases in 1924 indicates that the railroads have already taken a step forward in replacing their obsolete tools. In view of the promising business outlook for 1925 there is every reason to believe

that programs looking toward modernizing shop equipment will be developed on an even larger scale than during 1924.

Take up the lost motion

It is an established fact that one of the important factors in obtaining the maximum amount of output from a piece of machinery is to eliminate from it all lost motion. It is a common sight in the average busy locomotive repair shop to see workmen promenading up and down the aisles of the shops wasting valuable time that should be used for productive purposes. Upon investigation it will be discovered that these men are either going after tools or material, or are looking for the foreman to secure an order for material. Further investigation will reveal the fact that considerable time is lost in the morning and at lunch hour in starting promptly to work when the whistle blows. Some of the men will be found in groups engaged in a discussion of some sort; others may be reading, and still others taking a nap. These men will finish their discussion, complete the article they are reading, or slowly arouse from their sleep, gather their tools and amble back to their work. This is a daily occurrence and eats up valuable time.

Take, for an example, a locomotive repair shop employing 200 men. These men will average seven minutes a day getting started to work after the whistle blows (this is a very conservative figure). This will total up to approximately 47 man-hours a day, or 282 man-hours a week. Assuming an average of five minutes a day per man lost in securing tools, material or orders for material, which is a conservative average, in a week's time a total of 102 man-hours will be lost in this manner. These two items will amount to 384 man-hours a week, which, figured on a basis of 60 cents an hour, will amount to $230 a week, or $920 a month. If this is allowed to continue month in and month out, by the end of a year a little over $11,000 will be lost.

How can this situation be overcome? The time lost by the men in securing tools and material is a problem for the management to solve. The proper distribution of tools should be carefully studied and some means provided to reduce this source of lost motion to a minimum. One system of tool distribution which has been effectively used in various shops is to provide each machinist and his helper with a tool wagon in which to keep the tools he has occasion to use every day. Other tools, which are not so frequently used, are placed in the care of the foreman in charge who is held responsible for them. The specialization of mechanics on certain jobs keeps the number of tools required by each man within practicable limits for this scheme of distribution.

The distribution of material in railway shops has received considerable study in the past, but there is still room for improvement in many shops, especially in the convenient location of material stock bins in the shop for small parts. If the men are educated to the proper utilization of these bins, they will save themselves many unnecessary steps, and if they are working on a piecework basis, will increase their daily earnings. Another item which needs additional study is the method of giving out orders for material. In many shops the foreman in charge has to write out these orders. It is often the case that a workman seeking material, loses considerable time in locating the foreman before he can get an order for the material. A great deal of this lost motion could be overcome if the issuing of material orders were concentrated at one point in the shop where the men could get an order for what they want. This point should be situated on the way to the storehouse, or the point at which the material is kept; then no time would be lost.

After the management has, by the proper distribution of tools and materials, reduced to a minimum the non-productive hours lost through these sources, it is then in a position to solicit the co-operation of the men to do their part. When the men are convinced that the management is sincerely striving to eliminate wasteful methods and practices which, if accomplished, will benefit them as well as the company, then and only then will they co-operate in taking up the lost motion for which they are primarily responsible.

New Books

EYE HAZARDS IN INDUSTRIAL OCCUPATIONS. *By Louis Resnick and Lewis H. Carris, 247 pages, 6 in. by 9 in. Price $1.50 with linen and $2.50 with fabrikoid binding. Published by the National Committee for the Prevention of Blindness, Inc., New York.*

The National Committee for the Prevention of Blindness has been doing much towards bringing to the attention of industry and the country at large, the means of eliminating the causes of eye injuries in industrial occupations. In publishing this volume, it has undertaken to serve as a clearing house for the great fund of information regarding this particular hazard which has been developed by the numerous industrial associations, governmental agencies and individual corporations interested in accident prevention and health promotion.

The volume has 10 chapters with 59 illustrations and three appendices. The various chapters include such subjects as the nature and cause of eye injuries, the elimination of eye hazards by engineering revision, first aid treatment for eye injuries, the correction of defective vision and diseases affecting the eyes. Railway officers and safety inspectors will be particularly interested in the chapters on industrial lighting and safety education. These chapters are well illustrated and the effects of poor lighting, the proper amount of illumination required in shop buildings, the education of officers and employees and the enforcement of safety rules and regulations, are discussed in an instructive and entertaining manner. Appendix I gives a list of industrial poisons that present hazards to the eyes. Appendix II consists of the goggle code of the American Steel and Wire Company. Appendix III is a supplementary reading list on the subject of eye hazards.

This handbook, which was written to replace publication 12, issued in 1917, furnishes a wealth of valuable information for safety engineers, inspectors, committeemen, physicians and nurses.

A STUDY OF THE LOCOMOTIVE BOILER. *By Lawford H. Fry. 157 pages, illustrated. 6 in. by 9 in. Price $4.00. Published by the Simmons-Boardman Publishing Company, 30 Church street, New York.*

This volume is planned as a study of the operation of the locomotive boiler and to deal with tests and methods of testing. No particular attention is given to details of construction and familiarity with the general arrangement is assumed. Beginning with the experimental tests on locomotives of the Liverpool and Manchester Railway in 1834, the progress of testing methods is outlined down to the present time. The theory of combustion and the relation of various forms of fuel to the generation of steam in locomotive boilers are analyzed. In studying the operation of a locomotive boiler it is highly desirable to draw up a "heat balance"; that is to say, to ascertain how the heat available in the coal fired is distributed, to find what proportion is usefully employed in evaporation and how the remainder is divided among the various avenues of loss. Chapter III outlines the data necessary and the method developed for computing a heat balance. The chapter fol-

lowing offers for comparison a number of balances thus obtained. Chapter V deals with the detailed study of the processes by which the heat produced by combustion is taken up by the boiler heating surfaces. Two distinct and independent processes are involved; that of radiation from the fire to the firebox surface and that of transfer by contact of the heated gases with the cooler boiler heating surfaces. Equations are developed for carrying through the computations for both cases and typical examples given for applying these formulas. The following chapters deal with the transfer of heat from the gases to the flues with a consequent progressive fall of temperature of the gases as they pass through the flues and escape at the smokebox temperature. The general effect of the various conditions on the rate of heat transfer in flues is given with formulas from which the exact effect of these conditions can be computed. Tables to facilitate such computations are included.

A study of heat absorption as affected by the rate of operation and by the boiler dimensions and the methods of determining boiler efficiency constitute the final chapters in the book. Many useful tables, giving the results of tests, the proportions of boilers, combustion calculations, comparisons of calculated and test results and other data make up the final section in the book. For the designer, the railroad officer or student in locomotive design the information given in this book should prove of the utmost value as it is practically the only complete analysis of the physiology of the locomotive boiler; that is, the problems of the boiler that enter into the production of steam through the medium of proper combustion and the absorption of the developed heat by the boiler surfaces.

What Our Readers Think

Finding amount of wear in main rod brasses

Lynchburgh, Va.

To the Editor:

It is a regular occurrence for enginemen to report that both ends of the main rods are pounding badly. The usual manner in which the inspector determines the amount of wear in the brasses is to try them with a pin bar. This is a poor practice on account of the heavy weight of the modern main rod. Another way is to remove the brasses and caliper the pins and brasses. This method is positive but consumes a great deal of time.

I determine their wear by the tram method. I carry with me a small 5-in. by 2-in. tram. When the brasses of a locomotive are reported as having excessive wear, I have it spotted on the top quarter. I then put a center punch mark on the crosshead near the front end key and place one end of the tram in it. The hostler then applies the brakes, opens the throttle, and reverses the locomotive several times. In doing this a mark will be scribed on the main rod which, when measured, will show how much the brass will have to be closed.

The wear of the back end brasses may be determined in the same manner, except that the punch mark is put either on the eccentric crank arm or near the center of the main crank pin.

The amount that the driving box wedges are out of taper, can be determined in the same way. Place the locomotive over a pit and set the wedges up tight. Put a center punch mark near the top and bottom of the driving box. While the hostler is "pumping" the engine, scribe on the engine frame the amount the wedge is out of taper. This will give the amount to be planed off the wedge and also which end is to be planed. W. R. McIvor.

A word in favor of charcoal iron

Parkesburg, Pa.

To the Editor:

In the September number of the *Railway Mechanical Engineer* there was published an abstract of a report of the committee on Pitting and Grooving in Boilers of the Master Boiler Makers' Association in which it was stated that: "It is generally believed that charcoal iron is more homogeneous than steel and that iron tubes are, therefore, more resistant to corrosion than are drawn steel tubes. Whether or not this is true, the writer is not prepared to say. It would seem as if steel could be made as homogeneous as iron and it is evident that if it were so made, it would be just as good."

There is another important reason for the superiority of charcoal iron boiler tubes, namely, the presence of slag, which is thoroughly distributed throughout the metal. The product of the charcoal knobbling fire is a sponge consisting of globules of practically pure iron, the pores of the sponge being filled with molten slag. The subsequent heating and mechanical operations necessary to convert the crude iron into a finished product, draw the slag out into filaments or thin strips which, while not continuous for the length of the tube, overlap to such an extent that every cross section of a charcoal iron boiler tube, will show a remarkably complete distribution of slag. An analysis of a finished tube or sheet of charcoal iron will reveal a surprising chemical uniformity.

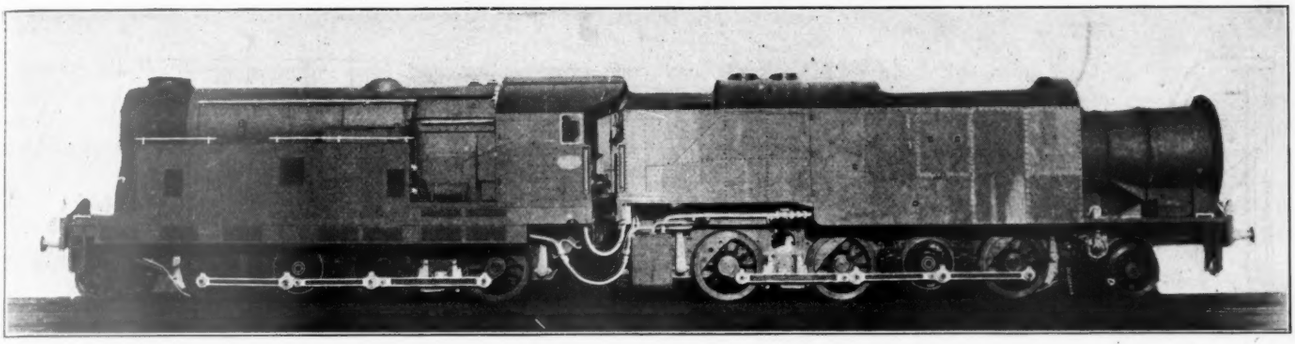
Steel on the contrary is purposely freed from slag before it is poured into the moulds where, on account of varying densities and gas pressure, the mass is in constant ebullution until it freezes. Due to this internal motion and the fact that the impurities are lighter than iron, they are found to be segregated, generally towards the top center, but also to a certain extent, throughout the entire ingot.

The presence of the slag or cinder filaments in wrought iron is responsible for the well known fibrous appearance of its fracture when nicked and broken. The resistance to fatigue shown by wrought iron, which is greater than that possessed by steel of an equal or even considerably higher tensile strength, is also very likely due to this subdivision of the cross section. In other words, the iron possesses to some degree, the greater resistance to repeated bending. This may be illustrated by a wire cable as compared with a solid bar of the same cross sectional area.

It is true that corrosion due to pitting is less likely to take place in a homogeneous metal than in one in which the impurities are segregated, by reason of the fact that chemical uniformity results in balanced electrical potentials. It is also recognized that no metal can be absolutely homogeneous and that under certain conditions pitting will occur. However, the point I wish to stress is that slag, being non-metallic, is definitely more resistant to the action of acids and to decomposition by electrolysis and consequently to corrosion in general, than pure iron. If corrosion does start, it is obviously of advantage to have within the metal barriers or obstacles of high resistance to corrosion to impede and check its progress so as to postpone failure or prevent it entirely.

This structural resistance to corrosion, possessed by charcoal iron, is of equal if not greater importance than the homogeneity of the metal in comparison with steel, in respect to the greater service that may reasonably be expected of charcoal iron. S. H. Woodroffe,

Metallurgical engineer, Parkesburg Iron Co.



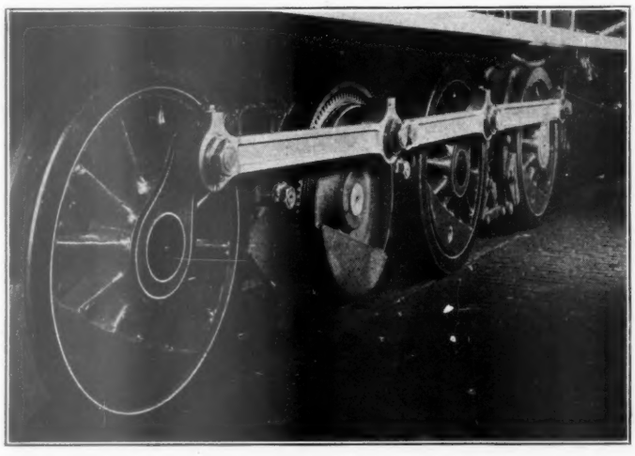
Side view of the Ramsay turbo-electric locomotive

Ramsay turbo-electric locomotive*

Practicable condenser of evaporative type developed—Speed of running controlled electrically

By George F. Jones and T. Laurence Hale

IT may be said that just as the cylinder, boiler and firebox have become fundamental parts of the ordinary locomotive, so do they determine the degree of its thermal performance and the limit of its possible power development. With the present-day demands for increased hauling capacity together with greater need for economy in fuel consumption, emphasizing, in these respects, the limitations of the orthodox designs of locomotives, it is not surprising to find engineers contemplating the attractive possibilities offered by locomotive development along lines other than the conventional.

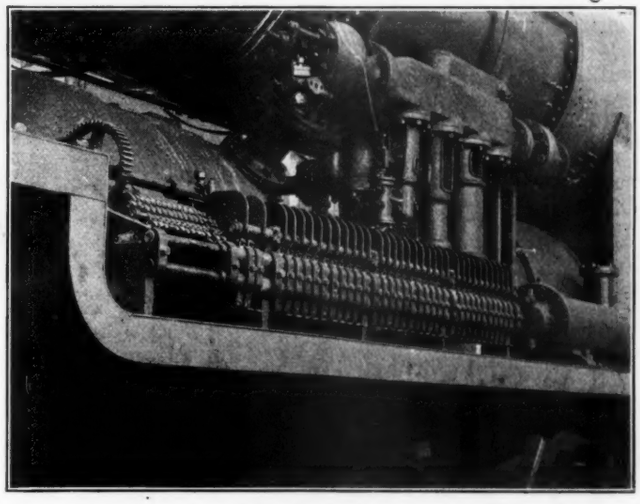


Power is transmitted to the driving wheels by a spur pinion and wheel which are enclosed, and run in an oil bath

It is apparent that there is great room for improvement when it is considered that a locomotive of the ordinary type has a thermal efficiency of only approximately six per cent and that doubling its thermal efficiency would reduce the fuel consumption by half or, alternatively, allow a much more powerful engine to be built with the present practical limits of firebox area.

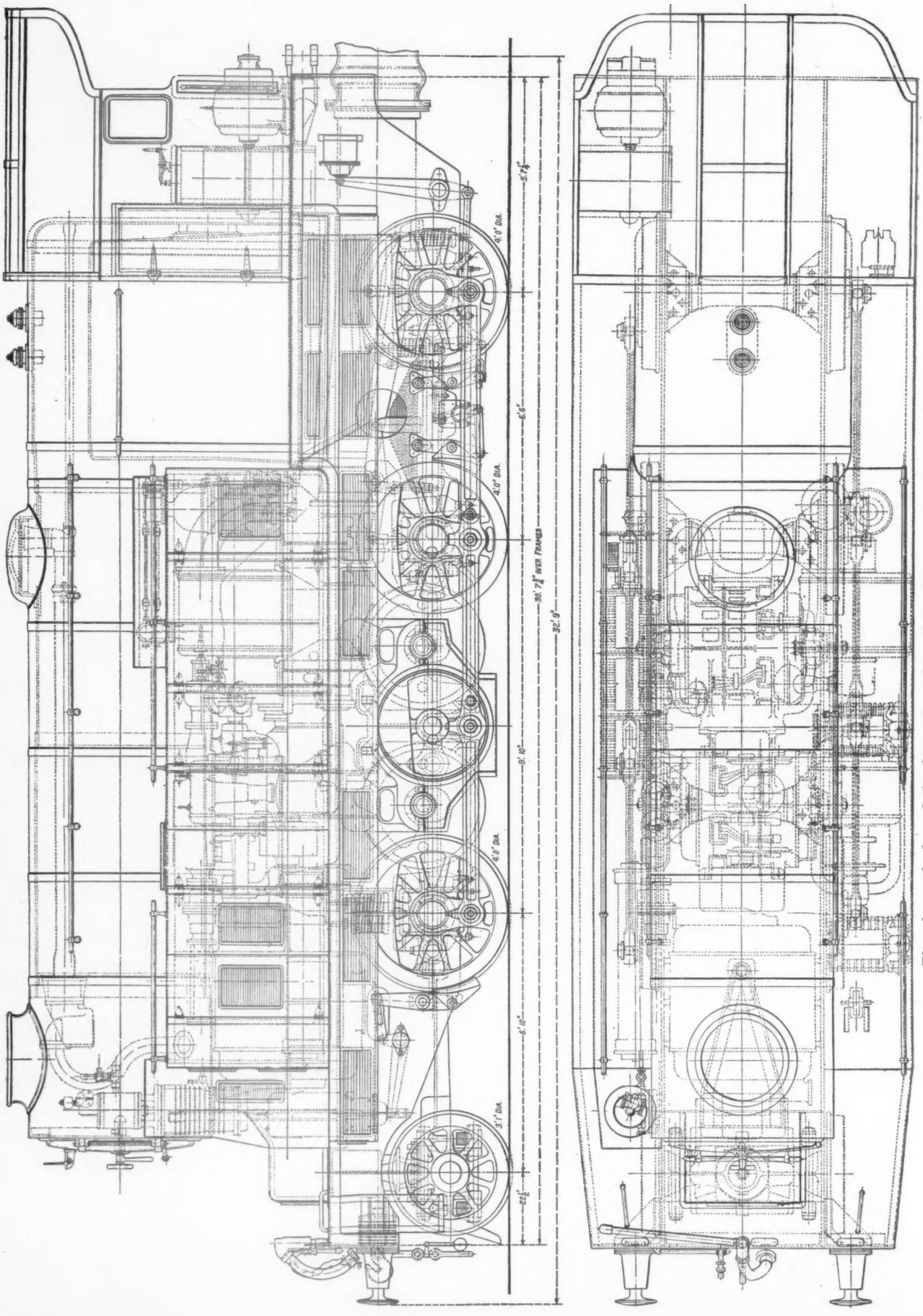
The replacing of cylinders by the steam turbine is an innovation in locomotive construction, but not more so than the application of condensation which is rendered possible by its introduction. From a thermodynamic point of view, it is evident that turbo locomotives, whatever their systems of power transmission, whether electrical or gear, largely depend for their economies in fuel consumption upon the efficiency and reliability of their condensing plant.

It is to be understood that the Ramsay locomotive is regarded as experimental, designed and constructed for the purpose of obtaining technical data and demonstrating the capabilities of the type. It conforms to British standard practice as regards the restrictions imposed by the load line gage, etc., although, naturally, in view of the radical departure in design, it has been confined mainly to test and demonstration running, rather than everyday service. It may be mentioned that compact and uniform designs were disregarded in the interests of experiment, the motor driven auxiliaries, in every case, having



Covers removed on right side to show the grid resistances and turbine governor

* Abstract of a paper presented before the annual meeting of the Railroad Division of the American Society of Mechanical Engineers.

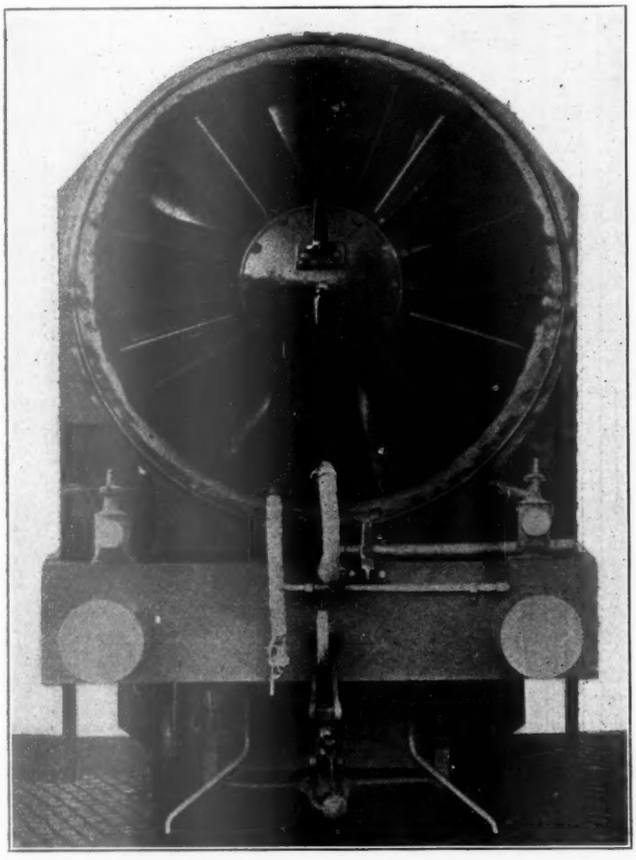


Elevation and plan of the forward section of the Ramsay turbo-electric locomotive

been purposely kept separate and ungrouped from the main power plant in order readily to obtain their particular power consumptions. In addition, many power registering devices, gages and instruments have been fitted, greatly in excess of those necessary to the ordinary equipment, all of which tend to give the locomotive, especially the cab, an intricate and complicated appearance.

General description

The locomotive consists of two portions, the front and rear, connected by a special form of universal joint. The front portion incorporates the boiler, forced draft set and driver's cab, the main turbo-alternator set and the auxiliary direct-current turbo generator being situated under the boiler. The rear portion of the locomotive is practically devoted to the condensing plant with axial fan,



Rear view of the locomotive showing the condenser fan

condensate extracting pump, etc. Room, however, has been found for the main water tank and coal bunker. Communication between the turbines and condenser is by way of the 24-in. diameter exhaust pipe which is provided with a flexible rubber connection reinforced by internal rings of aluminum.

Each portion of the locomotive carries two driving motors, each pair of motors being bolted to a center cross-bearer which carries a transmitting shaft and spur wheels. Pinions are keyed to the motor shafts and these mesh with the spur wheels, the power being finally transmitted through coupling rods from the spur wheels to the driving wheels in the ordinary manner. One of the illustrations shows the spur wheel and pinion shafts, the pinions having been removed. Both are enclosed in a gear case and run in an oil bath. The gear ratio is 2.8 to 1.

The main turbine is of the impulse type and contains nine stages. The mean blade diameter is 36 in. It is designed for a steam pressure of 200 lb. per sq. in., and the steam is superheated to a total temperature of 685 deg. F., exhausting to a vacuum of 27 in. The turbine is flexibly coupled to a three-phase alternator and has a speed range of 1,800 r.p.m. at starting to 3,600 r.p.m. at 60 m.p.h. The three-phase alternator is designed to develop 890 kw. at a maximum pressure of 600 volts.

The auxiliary turbine is a single stage machine flexibly coupled to a direct-current generator, which provides the energy for the excitation of the main alternator poles as well as for the auxiliary direct current motors driving the condenser fan, condenser rotor, condenser extracting pump and the forced draft set for the boiler. It also supplies the necessary current for lighting the train. The auxiliary turbine operates under the same steam conditions as apply to the main turbo set.

The boiler is of the ordinary locomotive type and the combustion chamber is supplied with air by a high speed forced draft set situated on the locomotive cab. A simple locking device is provided on the furnace door to prevent a blow-back, the door being prevented from opening by a safety catch when the forced draft fan is in operation.

The transmission of power from the main turbine to the driving motors is three-phase, current being supplied from the alternator to the four alternating current slip ring motors, each motor having a continuous output capacity of 275 b.hp. and one hour's rating of 360 b.hp.

The following are the tractive forces at the rims of the driving wheels for the acceleration period from rest to 60 miles per hour:

Miles per hour	Tractive force
Starting	22,000 lb.
15	22,000 lb.
30	11,050 lb.
60	8,600 lb.
Normal running, 60 miles per hour	6,000 lb.

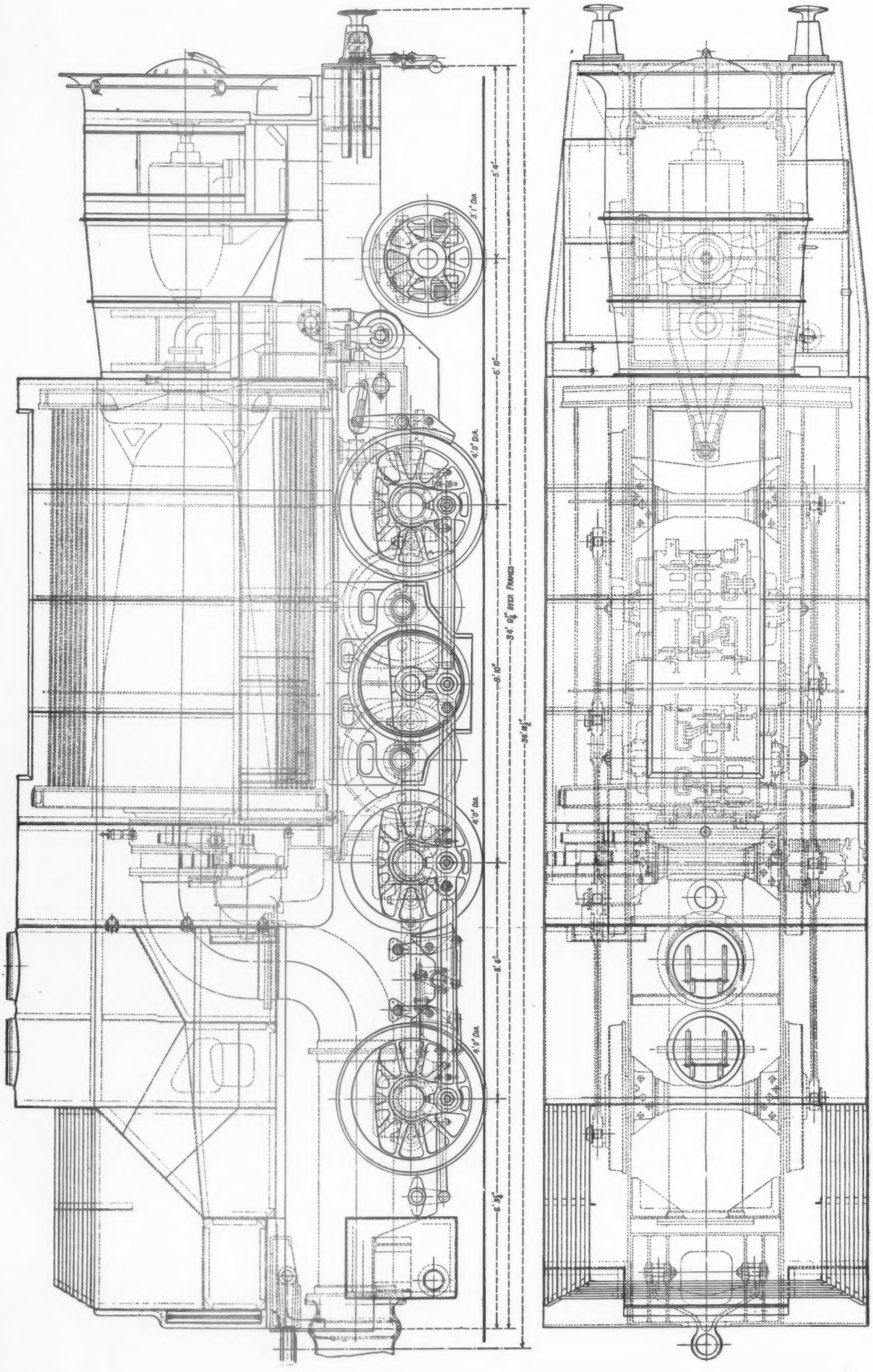
Design and description of the condensing plant

As the success of a locomotive of this description depends in such a large measure upon the design and action of its condenser, it is perhaps not irrelevant to give a very brief review of the groundwork which influenced the adoption of the principle of evaporation as the basis of design for the present condenser.

In the light of previous experience of the difficulties of recooling condensing systems, it was decided to attack the exhaust steam by direct means. It was fully realized that the alternative method to evaporation, that of direct cooling by air alone, involved employment of large condensing surfaces and excessive fan power, and that such a type of condenser would depend for its success largely on atmospheric conditions, and, while probably producing a satisfactory vacuum in low temperature countries, the system would be at a great disadvantage and far from satisfactory in hotter climates. Attention was, therefore, turned towards evolving a suitable condenser on the direct cooling system based on the evaporative principle as being the system to successfully meet the atmospheric conditions of all countries.

In design, the ordinary evaporative condenser has progressed but little and still remains practically as originally conceived; such test results as existed were unreliable and it was, therefore, necessary to carry out a series of preliminary experiments on small scale condensing apparatus with fans to produce a current of air and so intensify the evaporative effect. The importance of maintaining a thin and unbroken water film upon the condensing surfaces was easily demonstrated and, of the numerous methods and contrivances tested with a view to producing satisfactory water filming of the surfaces under a blast of air,

Elevation and plan of the forward section of the Ramsay turbo-electric locomotive



Elevation and plan of the tender and condenser section

the simple method of completely immersing the surfaces in water before exposing them to the air current was found to give the most reliable and proper film effect. Repeated tests on a small condensing plant proved the type to be exceedingly economical in water consumption, in practice only approximately one pound of water being evaporated to condense one pound of steam. The fan power required was reasonably low while the rate of heat transmission was found to be moderately high and sufficient to bring the condensing surface well within the practical limits.

Further experiments were carried out on a plant containing some 400 sq. ft. of surface. For the sake of simplicity, the condensing surfaces were composed of ordinary brass condenser tubes and, as a natural development to facilitate the process of filming, they were arranged in the form of a circular cage, or hollow drum. The drum, supported between bearings, was rotated in a tank containing water, the tubes passing through the water as they rotated.

The condenser was supplied with air by an axial fan and was tested in conjunction with a steam regenerator and the necessary wet air pump, water filming of the surfaces and resultant evaporation taking place successfully. The promising results from this experimental work led to the design and construction of the present locomotive condenser.

Reference to the drawing shows the general arrangement of the rear portion of the locomotive. Ordinary condenser practice was observed in the construction of the drum, which consists of an annular nest of standard ¾-in. brass condenser tubes ferruled into two headers. The exhaust steam entering one header is condensed, and the resultant condensate is collected and drawn off from the other header and returned to the hot well by the rotary extraction pump as hot and clean feed for the boiler. The casing, the bottom of which forms a tank containing the water for purposes of filming which is fed from the main tank. A pneumatic float maintains the water at a constant level.

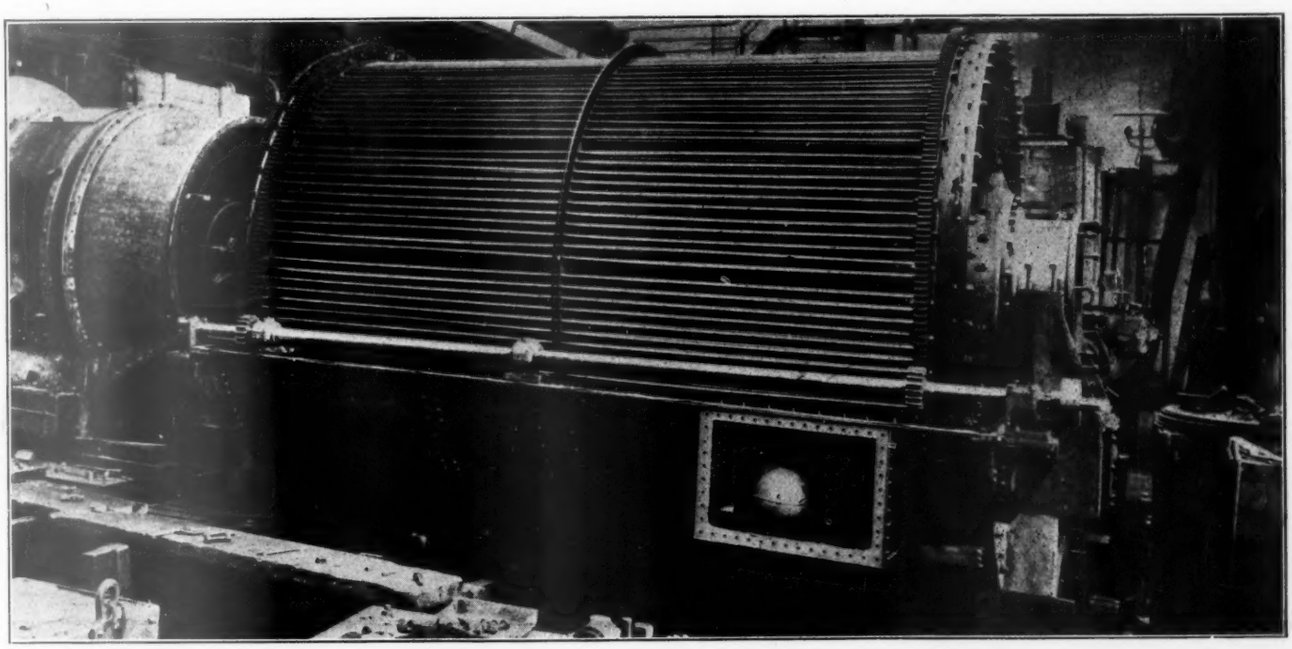
The condensate extracting pump is of the ordinary rotary condenser design, while the air pump is of the steam ejector type and has two stages; it is supplied with steam from the boiler through a reducing valve.

Before being erected on the locomotive, the complete condensing plant was fully tested in conjunction with a 1,500-hp. triple expansion engine and satisfactory results were obtained.

Control of power and speed regulation

As will be seen, the starting torque of the motors is about three times that of the normal and is obtained as follows: Before starting the locomotive, the auxiliary turbine is run up to speed, 3,000 r.p.m., thus providing excitation for the main alternator and energy for the motor-driven auxiliaries. The main turbine set is then run up to half speed; viz., 1,800 r.p.m. At this period the motors are connected in cascade by the master controller in the driver's cab. It is then that the locomotive may be started.

It is well known that when a turbine speeds up from rest to full speed, its torque decreases in the ratio of 2 to 1, and when passing through the period of half speed its torque is one and one-half times the normal. This is the torque of the main locomotive turbine when running at starting speed; namely, 1,800 r.p.m. Again, two alternating current motors when connected in cascade and running at half the alternator speed have twice the turning moment that they have when connected in parallel with the same power consumption. Therefore, with the driving motors in cascade and the main turbine running at half



General view of the condenser with its casing removed

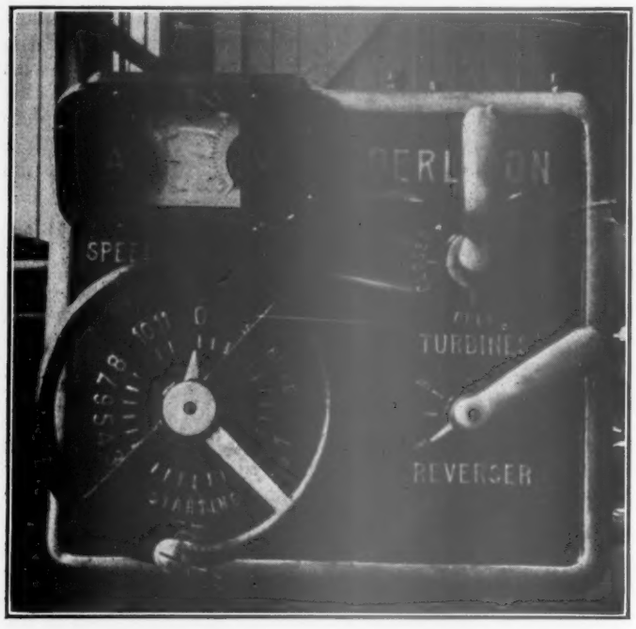
trunnions of the respective headers are fitted with air tight glands of the steam sealed self-adjusting type. This design of gland has given every satisfaction in resisting air leakage into the condenser.

As will be seen, a small motor, driving through a spur gear, turns the drum which is housed in a sheet metal

speed, the torque from rest to quarter speed will be two times 1.5, or three times the normal torque. The motors now being connected in parallel, the turbine still running at half speed, the speed of the locomotive increases from one quarter to one-half speed and the torque is then 1.5 times the normal. The turbine speed is then increased

to the maximum and the torque drops from 1.5 times the normal to normal.

In controlling the speed of the Ramsay locomotive from



The entire control of the locomotive is centered at this master controller

rest to 60 m.p.h., the following sequence of operations is observed: After the main and auxiliary turbines have been brought to speed by means of the hand wheels in the cab which control the steam inlets, all control of the locomotive is carried out electrically by means of the master controller in the cab. To start the locomotive, the controller wheel is moved to the first notch, thereby closing the excitation circuit of the alternator and connecting the driving motors in cascade with resistance wholly in circuit. Further movement of the control wheel cuts out resistance until a first running position of 15 m.p.h. is obtained. If a greater speed is desired, the controller wheel is moved further which changes the motor connections from cascade to parallel. The excitation circuit being again closed, the motors once more operate under current, resistance being cut out until a second free running speed of 30 m.p.h. is reached.

Further increases of speed are obtained by further moving the controller wheel around, step by step, whereby the setting of the main turbine governor is correspondingly altered, that is, the speed of the turbo-alternator is increased and thereby the periodicity. In this manner the speed of the locomotive can be increased from 30 to 60 m.p.h. A reduction in the speed of the locomotive is obtained by turning the controller wheel quickly back to the zero position, thus observing the reverse succession of operations to those of starting up to full speed. The excitation circuit being opened, the motors are without current and ready for starting up again in cascade.

Reversing the locomotive is, of course, effected by reversing the driving motors in the ordinary way. The general arrangement of the front portion of the locomotive is illustrated, showing the resistances, which are of the grid type, arranged under the running plates on either side. Both vacuum and Westinghouse brakes are fitted.

Principal dimensions and proportions

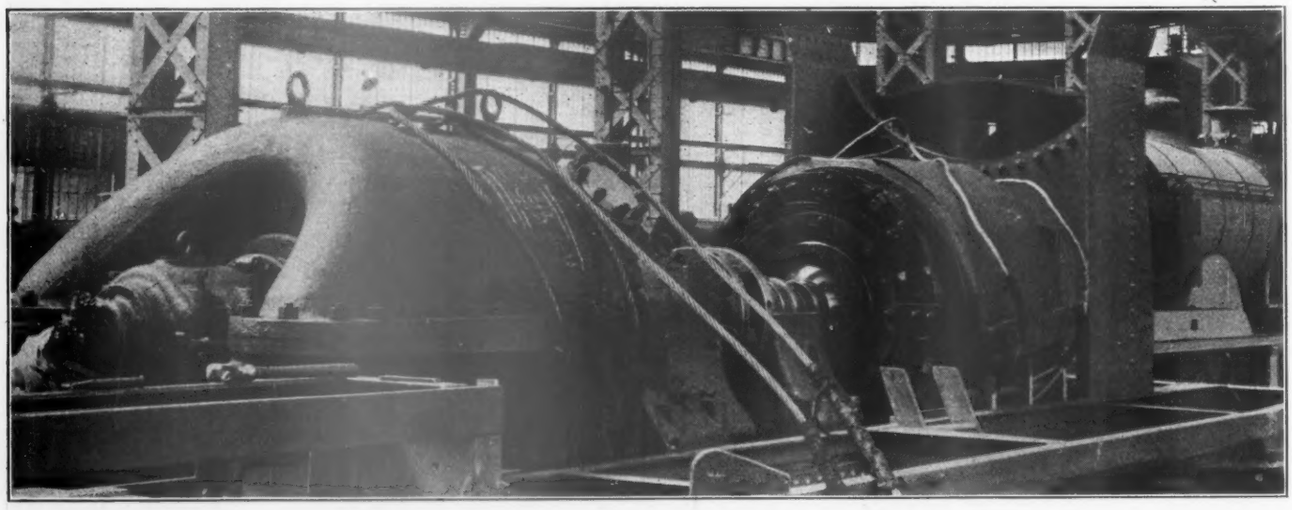
Length overall	69 ft. 7 in.
Length wheel base, total	59 ft. 4 in.
Length, rigid wheelbase	16 ft. 4 in.
Driving wheel diameter	4 ft. 0 in.
Height from rails to center line of boiler	10 ft. 3 in.
Maximum width	9 ft. 0 in.
Total heating surface of boiler	1,543 sq. ft.
Grate area	28 sq. ft.
Tractive force at starting	22,000 lb.

Shop and main line testing

The trials to which the Ramsay locomotive have been subjected have extended in one form or another over a prolonged period and often under adverse atmospheric conditions.

Shop tests, to ascertain the reliability of the special electrical control, were carried out before the locomotive proceeded to the Horwich works of the London, Midland & Scottish for actual running trials. By disconnecting the terminals of the alternator and connecting it to water resistance, it was possible to make many tests which did not justify a main line trail and afforded convenient means of obtaining readings on the condenser which would otherwise have been difficult to procure with the locomotive in motion. Numerous tests were made under these conditions and a large amount of technical data collected.

In addition, several main line trials have been accomplished and on these occasions the locomotive hauled heavy trains without difficulty, a vacuum ranging from



Turbo-generator unit on locomotive frame during assembly

80 to 95 per cent being regularly attained and held. Smoothness of running was pronounced, due to the constant and even turning moment exerted by the driving motors.

At no time during the run did the temperature of the condenser exceed 135 deg. F. which corresponds to a vacuum of 25 in. of mercury. The work of running and firing was carried out by ordinary railway employees and, as all the work in speeding up the locomotive is performed electrically, the duties of the engineman, so far as controlling the locomotive is concerned, are confined to the turning of the controller wheel, the operations of which have already been described, while the duties of the fireman are not as onerous as those connected with the ordinary locomotive.

In considering the efficiency of the condensing plant, some regard must be paid to the amount of power consumed in its operation, and, as in this case, the major portion of the cooling is due to evaporation, the power absorbed by the fan is proportionately low. The average power consumption for the three-condenser auxiliary motors ranges between 25 b.hp. at low loads to 40 b.hp. at high loads. The heat from the air ejector steam exhaust was recovered in the hot well.

No difficulties were experienced on account of deposits of scale and, although the filming water was far from pure, the slight scale which formed on the tubes assisted rather than impeded the water filming. Inspection of the inside of the tubes and headers showed them to be clean and free from deposit or corrosion after some months running.

The foregoing is but a brief description of a locomotive which has proved beyond doubt that the application of the turbine and condenser to locomotive use is rational and reliable. The transmission of energy from turbine to locomotive wheels may be either carried out by mechanical gears interposed between the turbine and wheels, or electrical means may be employed. For moderate powers, there is much to be said in favor of the former, but for large powers the balance of the advantages lies with the latter means.

The exhaustive tests taken over a long period have demonstrated conclusively that there is now little difficulty in providing condensing apparatus which will maintain the requisite economical vacuum when dealing with the heaviest traffic.

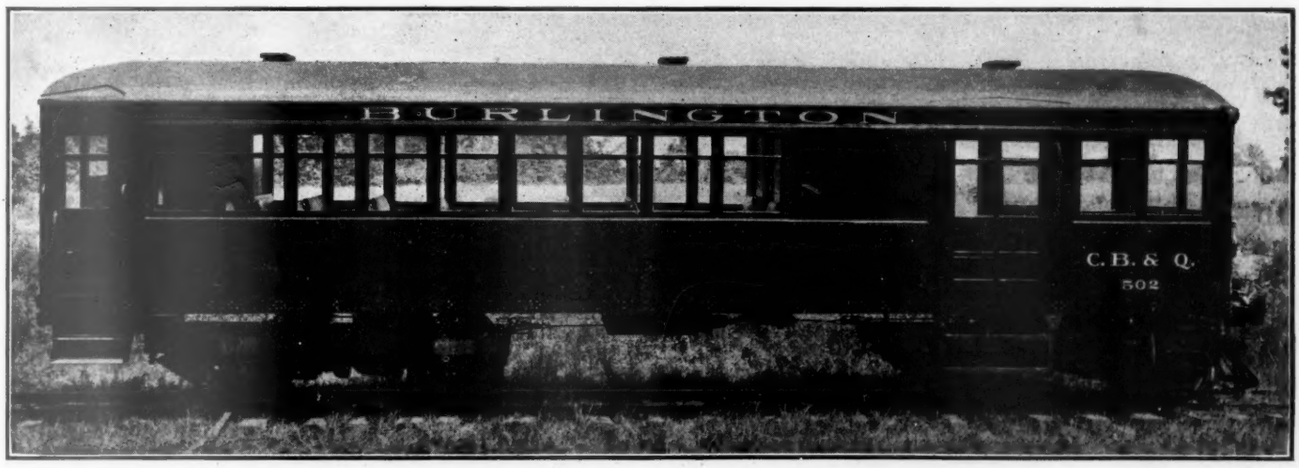
Gasoline car with independent power units

New self-propelled car for the Burlington embodies several unusual features of design

THE Edwards Railway Motor Car Company, Sanford, N. C., has recently completed a gasoline motor car for the Chicago, Burlington and Quincy which represents an interesting departure from the usual design of this class of equipment. The motors, one on each truck, are not only entirely removed from the car body with a consequent saving of space, but are arranged for independent operation, to permit handling the car under varying operating conditions with greater economy.

This car is equipped with two double trucks into each one of which has been built a complete power plant which can be operated independently or together as operating conditions may require. This construction serves to eliminate all direct motor vibration from the car body; eliminates universal joints, long drive shafts, angle drives and numerous gears. An additional advantage is the fact that no space is taken up in the car body for the motors. If one power plant should fail completely, the other unit remains to operate the car. This construction also has a maintenance advantage in that an extra or reserve power truck can be kept on hand and if a mechanical failure occurs, the trucks can be changed in about 45 minutes.

Both front and rear trucks follow closely the conventional four-wheel passenger coach type of construction, with such modifications as are necessary to install the power plant. Wheels are 30 inches in diameter, rolled



Edwards gasoline rail motor car with a motor on each truck

steel A. R. A. contour; outside journal boxes are used and are fitted with Hyatt roller bearings; the axles are four inches in diameter and are made of chrome nickel steel, heat treated. Coil springs are used over each journal box. One large transverse semi-elliptic spring is located under the bolster.

The power plant

Each power unit consists of one Buda four-cylinder motor, 5-in. bore by 6½-in. stroke, developing 60 hp. at 1,200 r.p.m. A heavy-duty multiple disc clutch transmits the power to a four-speed transmission of the constant mesh type which, together with a special final drive and reverse mechanism, provides the same number of speed changes in both forward and backward directions.

The complete power plant is mounted on a sub-frame which is suspended within the regular truck frame by four cantilever springs attached to swing motion hangers. The connection from the final drive to the axle is with two chains running in oil tight housings. This method of mounting, which is patented by the builder, permits the frame containing the power plant to move vertically or horizontally and as there is no rigid connection between the driven axle and the power plant frame, the driving machinery is protected from rail shocks and vibration, which is essential to the life of the machinery in a self propelled car, and especially so when the power plant is on the trucks.

One 65 gallon gasoline tank is located under the car body, arranged for convenient filling from the outside. This tank supplies fuel to both motors.

Over each motor there is placed a trap door in the floor which permits access to the motor for making all necessary adjustments, removal of cylinder heads, grinding valves, etc. The motors are also easily accessible from the outside of the car from each side. The truck can be removed from under the car in a very short space of time, and with the truck out the entire power plant is accessible for all kinds of repairs.

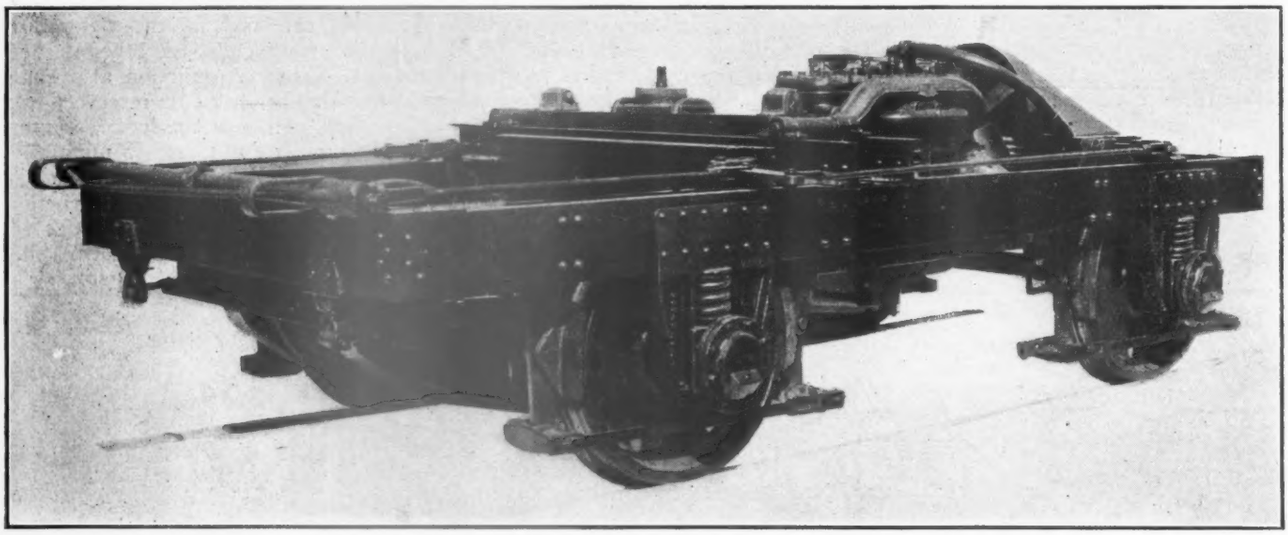
Each power plant has a separate set of controls so arranged that both motors can be operated separately or together as desired. A mechanical control, simple in construction is used because of the fact that in changing transmission gears, it is necessary for the operator to use the sense of touch and feel the gears in mesh, which can be done only with a mechanical control. For example, should the car be running with only one motor at a speed say of 25 or 30 m.p.h. and the driver sees the necessity of using the second motor to ascend a heavy grade, he can start up the second motor and put it directly in high gear without any clash of gears as he can easily bring the gears in mesh by the sense of touch.

In some designs of self propelled railway cars, considerable power is taken from the motors operating the car for operating various accessories such as the air compressor, electric lights, radiator fan, etc. On this car, no power is taken from the driving motor for these purposes. The total horsepower output of the motors is used to propel the car.

Interior view of the passenger compartment

The two engine principle offers possibilities for economy in that it permits the use of one engine on level track and with light loads, and both engines on grades and for heavy loads. The power and fuel consumption thus keeps pace with actual needs. In handling heavy loads this method reduces to one half the amount of load and strain on the clutch and transmission gears as compared to cars with only one power plant, thus reducing the wear and maintenance of these parts. The car is so designed that when only one power plant is used, none of the parts or machinery of the second power plant are in motion (except the drive sprockets and chains). Therefore, there is no wear on the power plant that is not in use.

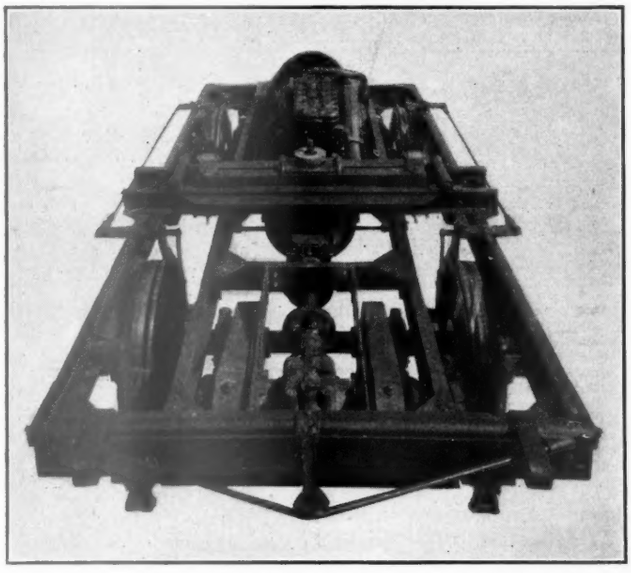
A Kohler automatic light and power plant is installed



Rear and side view of the truck, showing the brake arrangement and journal boxes

in the driver's cab. This plant furnishes 110-volt direct current for operating the lights of the car, driving the air compressor and operating the motors of the heating system. The lighting plant has 2,000 watts capacity and is driven by a small 3-hp. 4-cylinder motor, the complete unit occupying a floor space of only 15 in. by 33 in. In addition to the above electric plant, each driving motor is equipped with a generator, self-starter and a storage battery. This system will also supply current to several auxiliary lamps located in the car for emergency use. The electrical equipment includes a powerful 240-watt headlight.

A complete standard Westinghouse air brake system of the straight air type with emergency feature is installed



Top view of the truck, showing the motor suspension and driving arrangement

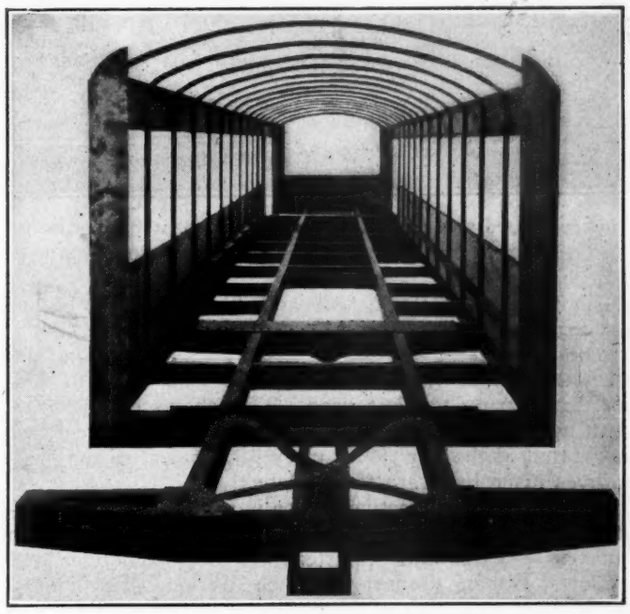
on the car. The air compressor is of the regular street car type, operated by the auxiliary power plant. In addition to this air brake system, there is an efficient hand brake system operated by a ratchet located conveniently for the driver.

In view of the fact that the motors drive separate axles and are in no way connected except through the rails, it is not necessary that they be perfectly synchronized. Through the control system, the motors are synchronized near enough for all practical purposes. In operation no loss of power can be detected due to any failure of perfect motor synchronization. It is possible to cut either motor in or out while the car is in motion. When 75-hp. motors are used, a maximum speed of 45 m.p.h. can be obtained on level track and with 100-hp. motors 55 to 60 m.p.h. The car will operate at the same speed in both forward or backward directions.

The car body is constructed of steel with wood interior finish. The center sills are 8-in. 20.5-lb. I-beams. The side sills are ⅜-in. by 3½-in. by 6-in. steel angles; the cross members are pressed steel shapes. The side posts are steel tees ¼ in. by 1¾ in. by 1¾ in. These tees also form the car-lines and are in one continuous piece, running from side sill to side sill. The corner posts are formed from 12-gage steel and run from side sill to letter panel. The side sheeting and letter panel is 16-gage patent leveled copper bearing steel. The letter panel extends about six inches back on top of the roof and is flanged down to form a stiffener for the roof. The roof is of the turtle back type, extending the full length of the car. Roof boards are ⅜-in. by 2½-in. tongue and grooved poplar, dressed to a smooth surface, painted and covered with canvas bedded in white lead. The rear platform is of the enclosed vestibule type with trap doors over the steps. The floor inside is laid with yellow pine of double thickness with a deadening felt between the layers. The inside finish, consisting of doors, sash, partitions and panels below the rail, is birch, stained natural mahogany. The car has one toilet with dry hopper and a Dayton sanitary water cooler. Parcel racks are provided in the passenger compartment which run the full length on both sides over the seats. The seats are of the non-reversible type with pressed steel pedestals, wall and aisle plates, upholstered in leather. The seats on one side of the aisle are 52 in. wide for three passengers and 34 in. wide on the other side for two passengers. This leaves a 23-in. aisle through the car. The total seating capacity is 41 passengers. The principle dimensions of the car are as follows:

Total length of car	43 ft. 0 in.
Length over car body	42 ft. 11¼ in.
Length of baggage compartment	17 ft. 0 in.
Width of baggage compartment	9 ft. 1 in.
Length of passenger compartment	22 ft. 7 in.
Width of passenger compartment	9 ft. 1 in.
Width over sheathing	9 ft. 6 in.
Height from floor to ceiling	8 ft. 0 in.
Height from rail to top of car	12 ft. 4 in.
Height from rail to floor	4 ft. 3 in.
Bolster centers	25 ft. 6 in.
Total weight	39,000 lb.

Attractive electric light fixtures are provided throughout the car. Other equipment consists of signal bell, air



Skeleton view showing the car body and underframe construction

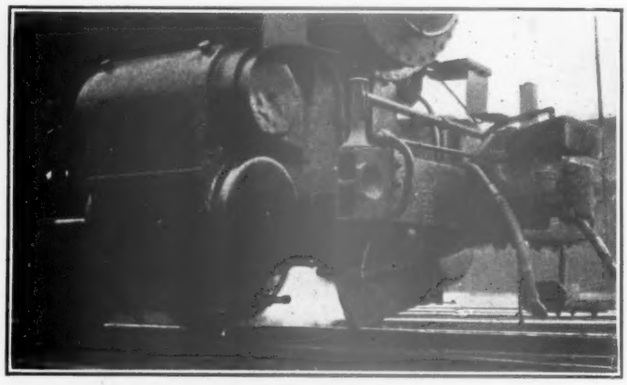
sanders, alarm bell operated by air, electric classification lamps, fire extinguishers and hot air heating system. Special light weight standard M.C.B. couplers are provided at both ends of the car, fixed at the standard draw bar height.

THE DETROIT, TOLEDO & IRONTON, aiming to provide safety in the greatest possible degree, has established a rule requiring that when cars are being pushed, particularly in yards and on industrial tracks, a brakeman must be stationed on the leading car, and he must have a mouth whistle. The same rule applies when yard engine, either pulling cars, or without cars, is moving backward; the brakeman must be on the footboard of the tender.

Bureau of Locomotive Inspection report

Conditions show the need for more careful inspection and thorough repair

THE thirteenth annual report of the chief inspector of the Bureau of Locomotive Inspection to the Interstate Commerce Commission for the fiscal year ending June 30, 1924, shows a reduction in the number of accidents and also in the number of persons killed and injured. A total of 1,005 accidents occurred in 1924 which were due to defective, inoperative or missing parts. The greatest number of accidents was due to defective grate shakers of which there were 96, 83 accidents were due to defective reversing gears, 66 to defective squirt hoses, 51 to injector steam pipes, 43 to boiler explosions, 41 to defective flues and 38 to defective brakes and brake rigging. An abstract of the report follows:



This footboard was caught on a frog and bent back, causing the trainman to be thrown to the track and seriously injured

The percentage of locomotives found defective decreased from 65 per cent during the year 1923 to 53.4 per cent during the last year. This shows an improvement in the condition of motive power during the year, yet below that of the year 1922, when 48 per cent of the locomotives inspected were found defective.

The condition of motive power is reflected in the number of accidents and casualties to persons resulting from failures of parts and appurtenances of locomotives and tenders. During the last year there were 1,005 accidents, resulting in the death of 66 persons and serious injury to 1,157 others. While this is a reduction as compared with the previous year, it is a material increase over the year 1922, when there occurred 622 accidents resulting in the death of 33 persons and the serious injury of 709 others.

During the year there were 43 boiler explosions, which resulted in the death of 45 persons and the serious injury of 59 others. The statement made above with respect to the total number of accidents during the year also applies to accidents due to explosions. The total explosions during the year decreased 24.6 per cent as compared with that of the preceding year, but an increase of 30 per cent over the year 1922.

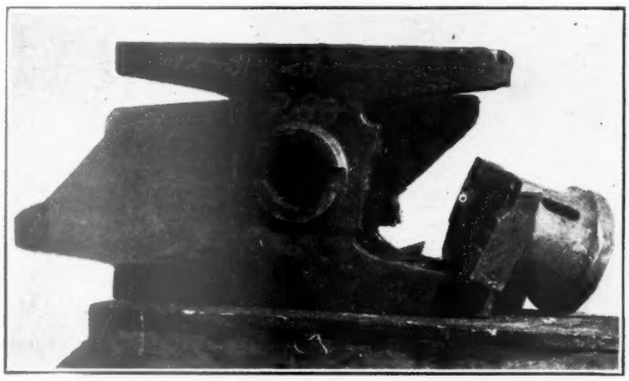
Attention is called to the increased seriousness of explosions as reflected by the loss of life. The effect of a boiler explosion is in direct proportion to the size and suddenness of the initial rupture which causes the explosion and the temperature and volume of the water in the boiler at the time of the accident. The volume of water increases with the size of the boiler and the temperature of the water increases as the steam pressure increases, consequently the failure of a large boiler carrying high pressure is much more serious in effect. This is illustrated by the fact that 57 explosions during the year 1923 caused the death of 41 persons, while 43 explosions during the last year caused the death of 45 persons. The

NUMBER OF LOCOMOTIVES REPORTED, INSPECTED, FOUND DEFECTIVE, AND ORDERED FROM SERVICE

Parts defective, inoperative or missing, or in violation of rules	1924	1923	1922	1921
Air compressors	1,221	1,390	971	692
Arch tubes	272	468	151	160
Ash pans or mechanism	257	306	161	147
Axles	19	21	15	12
Blow-off cocks	965	1,578	975	969
Boiler checks	1,329	1,913	949	1,006
Boiler shell	2,103	2,370	1,598	1,550
Brake equipment	6,920	8,213	4,577	4,836
Cabs or cab windows	1,627	1,423	1,276	1,171
Cab aprons or decks	1,293	1,476	1,098	893
Cab cards	758	1,449	567	671
Coupling or uncoupling devices	398	634	423	547
Cross heads, guides, pistons, or piston rods	3,577	5,527	1,920	2,116
Crown bolts	418	630	331	392
Cylinders, saddles, or steam chests	5,712	4,875	3,234	3,304
Cylinder cocks or rigging	2,376	1,745	1,201	1,197
Dome or dome caps	494	626	331	396
Draft gear	1,981	2,613	1,526	1,418
Draw gear	4,160	4,513	3,042	3,134
Driving boxes, shoes, wedges, pedestals, or braces	3,722	4,269	2,776	3,361
Fire-box sheets	1,471	2,327	1,191	1,185
Flues	698	1,268	521	552
Frames, tail pieces, or braces, locomotive	2,580	2,683	2,078	1,998
Frames, tender	414	540	352	232
Gage or gage fittings, air	626	1,062	399	537
Gage or gage fittings, steam	2,026	3,075	1,595	1,769
Gage cocks	3,835	5,895	3,275	3,657
Grate shakers	1,006	569	425	565
Handholds	2,241	1,990	1,533	894
Injectors, inoperative	94	251	94	179
Injectors and connections	9,985	12,406	7,741	7,606
Inspections or tests not made as required	9,740	7,419	4,114	4,865
Lateral motion	939	1,625	976	1,065
Lights, cab or classification	72	90	80	86
Lights, headlight	904	1,164	705	539
Lubricator or shields	565	566	456	427
Mud rings	1,901	2,711	1,598	1,441
Packing nuts	3,304	4,755	3,151	3,294
Packing, piston rod and valve stem	3,187	3,359	1,756	2,176
Pilot or pilot beams	967	1,294	679	588
Plugs or studs	1,026	857	443	457
Reversing gear	1,217	1,272	789	745
Rods, main or side, crank pins or collars	6,507	10,080	3,915	4,464
Safety valves	188	192	162	144
Sanders	1,806	1,857	1,165	1,071
Springs or spring rigging	6,335	7,911	5,497	5,494
Squirt hose	1,221	1,098	935	916
Staybolts	916	1,313	722	716
Staybolts, broken	5,320	10,089	4,261	4,871
Steam pipes	2,305	2,467	1,461	1,678
Steam valves	981	1,168	791	792
Steps	2,829	3,289	2,038	1,917
Tanks or tank valves	3,393	3,788	2,817	2,385
Telltale holes	620	715	630	567
Throttle or throttle rigging	2,868	2,633	1,880	1,730
Trucks, engine or trailing	3,425	3,899	2,467	2,493
Trucks, tender	5,977	3,714	2,551	2,408
Valve motion	1,269	1,761	710	691
Washout plugs	3,204	3,641	2,449	2,306
Water-bars or combustion flues	18	24	57	24
Water glass, fittings, or shields	4,201	5,641	3,640	4,045
Wheels	2,996	4,371	2,410	2,802
Miscellaneous—Signal appliances, badge plates, brakes (hand)	1,342	972	403	504
Total number of defects	146,121	173,840	101,734	104,848
Locomotives reported	70,683	70,242	70,070	70,475
Locomotives inspected	67,507	63,657	64,354	60,812
Locomotives defective	36,098	41,150	30,978	30,207
Percentage inspected found defective	53	65	48	50
Locomotives ordered out of service	5,764	7,075	3,089	3,914

reason that more people are not killed and injured by locomotive boiler failures is due to the fact that there are usually only two persons on the locomotive at the time of the accident. If such explosions were to occur at stations or other congested places, the results could not be estimated. These facts forcibly demonstrate the necessity for a high standard of construction, maintenance, and operation of locomotives. Because of defects developing from day to day and trip to trip, the utmost diligence must be pursued if serious accidents are to be avoided.

While most of these explosions were caused by the



Both webs of this crosshead contained old fractures extending over 75 per cent of the cross-sectional area

crown sheet having been overheated due to low water in the boiler, contributory defects or causes were found in 52.4 per cent of the cases, which again illustrates the necessity for better construction, inspection, and repair of all parts and appurtenances.

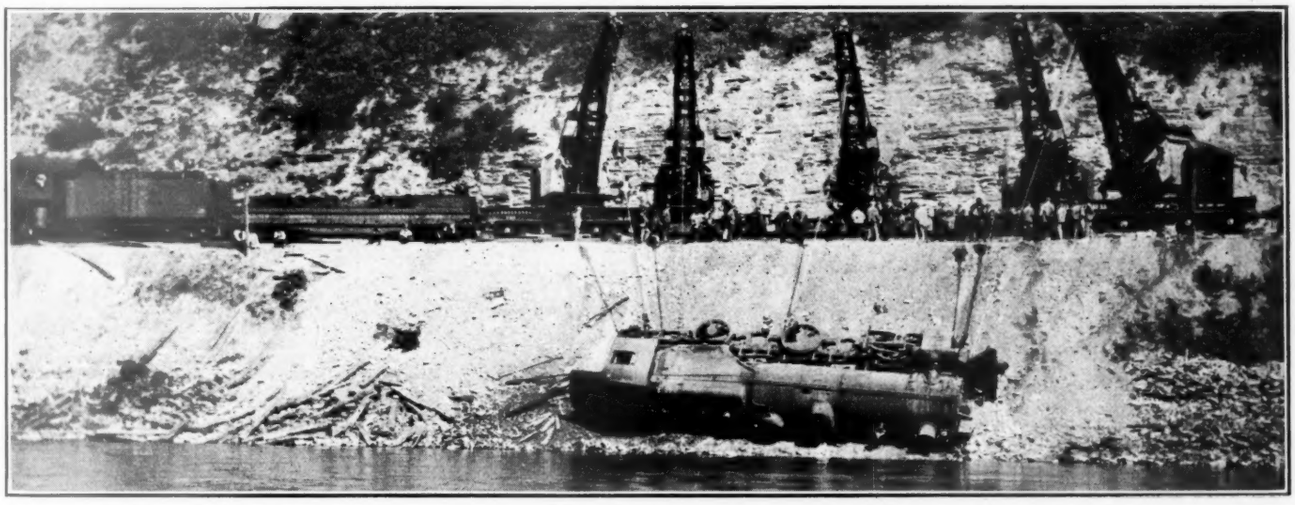
In the ninth, tenth, eleventh, and twelfth annual reports reference is made to investigations and tests made by this bureau on a number of railroads to determine the action of water in the boiler and its effect upon the water-indicating appliances. These investigations established without question that gage cocks when screwed directly into the boiler do not correctly indicate the general water level while steam is being rapidly generated and simultaneously escaping from the boiler. It is recommended that a suitable water column be applied to the boiler with three gage cocks and one water glass attached, with an additional water glass applied on the left side or boiler back head so that those operating the locomotive may have accurate knowledge of the general water level in the boiler under all conditions of service.

The water column as recommended is the most accurate device yet invented for this purpose. Accurate knowledge of the height of the water in the boiler is most essential to safe and economical locomotive operation. Water columns, as recommended, have been applied to practically all new locomotives constructed since the publication of our report and to a large number of locomotives previously in service. It is essential to safe and economical locomotive operation that water glasses and gage cocks be so constructed, located, and maintained that they not not only register the correct height of the water in the boiler, but that they be conveniently located and easily seen and read by the engineman and fireman from their usual and proper places in the cab. The duties of locomotive enginemen are among the most hazardous and exacting. Anything that detracts their attention for any length of time from the track and signals ahead creates peril to locomotive and train operation.

Autogenous welding has not yet reached a stage of development where it can be safely used on any part of the boiler where the strain to which the structure is subjected is not carried by some other construction which conforms to the requirements of the law and rules. This is also true in the case of fire-box crown-sheet seams where overheating and failure are liable to occur, on sheets which have been weakened from any cause to the extent of becoming unsafe and on seams on the boiler back head, except where the welded seams are covered with a patch applied with patch bolts, studs, or rivets which will prevent the escape of scalding water and steam into the cab, should the welding fail.

The most prolific source of casualties due to failure of autogenously welded seams has been in fire-box crown sheets and it has been conclusively demonstrated that the loss of life and limb due to fire-box failures depends very largely upon whether or not the sheets or seams tear.

Approximately 78 per cent of autogenously welded seams involved in fire-box failures have torn, while 15.4 per cent of riveted seams involved have failed. The fatalities where sheets tore have been about eight times as great as where they did not tear. From July 1, 1915, to June 30, 1924, autogenously welded seams were involved in 26.9 per cent of the crown-sheet failures, while 50.7 per cent of the total persons killed in such accidents was where the autogenously welded seams were involved. From the standpoint of safety, this clearly shows the



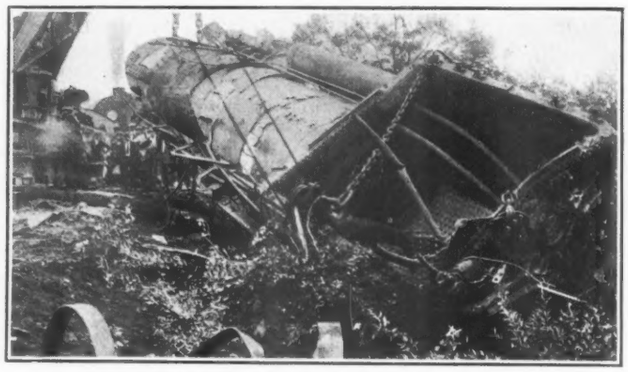
Locomotive derailed by the failure of a lug on a driving spring hanger gib, which allowed the hanger to work off the gib

necessity for construction of fire-box sheet seams in the strongest practical manner, especially in the so-called "low water zone", or on such seams as may be within 15 in. of the highest part of the crown sheet measured vertically.

The autogenous welding process is in a state of development and in order to avoid hindering the progress or development of any process of such great value when properly and discreetly used, the Bureau of Locomotive Inspection has hesitated to ask the commission to establish or approve rules or regulations restricting its use which might retard its development. However, unless the carriers confine its use to parts and appliances where there is less possibility of failure, accidents and injuries recommendations for more restrictive measures will have to be made in the near future.

Soon after July 1, 1922, it was brought to the attention of the commission that inspections, tests, and repairs were not being made by many of the carriers as required. It therefore became necessary for our inspectors to obtain information to show that locomotives were being used while in violation of the law so that court proceedings could be instituted. It was also necessary that our inspectors issue special notices for repairs in accordance with sections six and nine of the law, witholding 7,075 locomotives from service during that year until proper inspections and repairs were made. During the last year our inspectors were compelled to issue special notices for repairs which ordered 5,764 locomotives out of service.

Considerable improvement has been made by a large number of carriers, yet conditions are far from being satisfactory in so far as a proper compliance with the law is concerned. If due diligence is pursued by the carriers in seeing that locomotives are in proper condition and



Result of a boiler explosion due to low water

safe to operate before being offered for service, the commission's inspectors would not find it necessary to order any locomotive from service, which frequently causes serious inconvenience to the public as well as the imposition of an additional burden upon the carriers affected.

Derailments of locomotives on curves

A practical application—The factor of wheel bearing is worked out for a 2-10-2 type

By Roy C. Beaver and Marion B. Richardson†*

Part II

IN order to illustrate the practical application of the analysis given last month, let us consider the case of a Santa Fe type locomotive having the weights and dimensions given in Fig. 9. First find the actual weights on the rails under each wheel. Referring to Fig. 6 let $d = 60$ in., which is the gage of the track plus the width of one rail head plus the widening of the gage on the curve. Also let the height of the center of gravity of the locomotive be $h = 96$ in. and the elevation of the outer rail be $e = 4$ in. Then, from the formula $e^1 = \frac{eh}{d}$ we find the value of e^1 to be 6.4 in. Then we may reduce the formulas $R = \frac{W\left(\frac{d}{2} - e^1\right)}{d}$ and $R^1 = \frac{W\left(\frac{d}{2} + e^1\right)}{d}$ to $R = .393W$ and $R^1 = .607\ W$ for the outside and inside wheels respectively. Using these formulas and the weights given in Fig. 9, we obtain the following results:

Location	Wheel	Lb.
Leading truck	Outer	11,200
	Inner	17,300
First driver	Outer	22,165
	Inner	34,235
Second driver	Outer	21,969
	Inner	33,931
Third driver	Outer	23,816
	Inner	36,784
Fourth driver	Outer	23,501
	Inner	36,299
Fifth driver	Outer	23,698
	Inner	36,602
Trailing truck	Outer	22,990
	Inner	35,510

Considering the coefficient of friction between the wheel and the rail to be .20, and multiplying the above weights on the drivers by this factor, we obtain for the forces necessary to slide the wheels the following amounts:

Driver	Outer wheel, lb.	Inner wheel, lb.
Front	4,433	6,847
Second	4,394	6,786
Third	4,763	....
Fourth	4,700	7,260
Fifth	4,740	7,320

Now suppose we have two trailing truck centering springs in tandem, each spring having an outer coil 8 in. in diameter of 1-in. round steel and nine coils and an inner coil 5½ in. in diameter of ⅝-in. round steel and 15 coils. Also, let each spring have an initial compression of four in. and a further compression, due to curvature.

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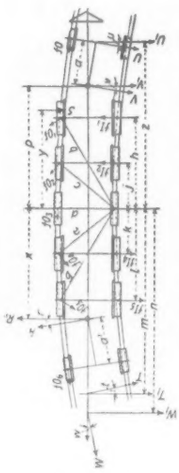


Fig. 1—A locomotive without flanges on a plane surface without rails

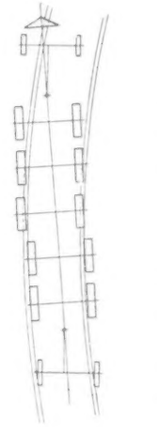


Fig. 2—A locomotive without flanges on a track

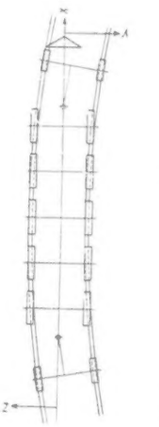


Fig. 3—Position a locomotive tends to assume when the guiding forces are removed

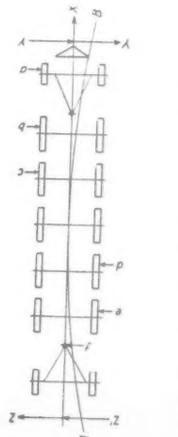


Fig. 5—The forces and reactions of a locomotive when curving

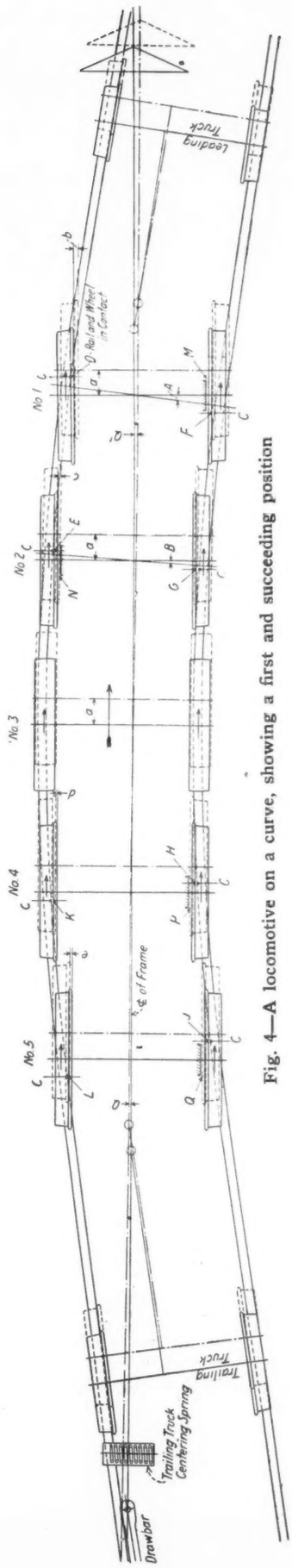


Fig. 4—A locomotive on a curve, showing a first and succeeding position

of two in., making a total of six in. Thus for the outer coil, $d = 1$ in., $r = 3.5$ in., $n = 9$ in. and $F = 6$ in.; and for the inner coil $d = \frac{3}{8}$ in., $r = 2.44$ in., $n = 15$ in. and $F = 6$ in. Substituting these values in the formula $T = \frac{FGd^4}{64nr^3}$ we obtain for the outer coil, $T = 3{,}037$ lbs. and for the inner coil $T = 821$ lbs. The sum of these two, or 3,858 lbs. is the load on the spring when compressed. If the angle $t = 1$ deg. 30 min., then $T_1 = T \cos t = .9996\ T = 3{,}856$ lb. This shows that the force T_1 may be considered equal to T for all practical purposes.

Suppose the drawbar pull to be the nominal figure of 30,000 lbs. acting through a two-degree angle. Its side thrust, then, is $W_1 = W \tan 2\ deg. = .0349\ W = 1{,}047$ lbs.

Having calculated the resisting forces, let us next consider their moments. We obtain by solving right tri-

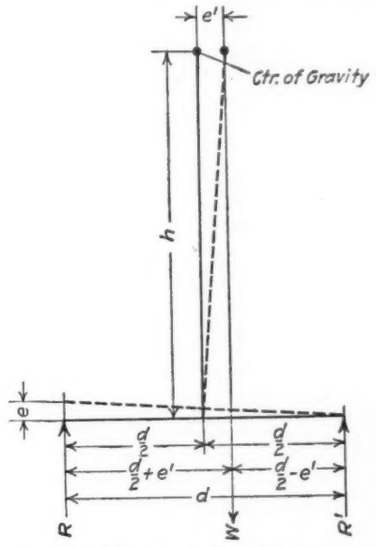


Fig. 6—Diagram showing the effect of the elevation of the outer rail

angles, the values for the diagonal distances given in Fig. 9. Using these values, and those for the other forces given in Fig. 9, we obtain the moments:

Driving wheel				In.-lb.
First outer	146.82	× 4,433	=	650,853
Second outer	89.94	× 4,394	=	395,196
Third outer	60.00	× 4,763	=	285,780
Fourth outer	89.94	× 4,700	=	422,718
Fifth outer	146.82	× 4,740	=	695,927
First inner	134.00	× 6,847	=	917,498
Second inner	67.00	× 6,786	=	454,662
Fourth inner	67.00	× 7,260	=	486,420
Fifth inner	134.00	× 7,320	=	980,880
Trailing truck spring	305.00	× 3,856	=	1,176,080
Draw bar pull	331.00	× 1,047	=	346,557
Total resisting moment				6,812,571

The next step will be to evaluate the overcoming reactions. If the leading truck weighs 3,500 lb., then the weight on the truck is 28,500 — 3,500 = 25,000 lb. Referring now to Fig. 7, if the distance from center to center of the rockers is 14 in., and the lateral movement of the bolster due to curvature is 4 in., then $r = 3$ in. and $s = 11$ in. From the formulas $Z_1 = \frac{Zs}{r+s}$ and $Z_2 = \frac{Zr}{r+s}$, we find these reactions to be 19,643 lb. and 5,357 lb. on the outer and inner rockers respectively. The angle z depends upon the design of the bolster, and is usually about 18 deg. The horizontal components of these vertical reactions are then $Y_1 = Z_1 \tan 18$ deg. $= 19{,}643 \times .3249$

$= 6{,}382$ lb. and $Y_2 = Z_2 \tan 18 \text{ deg.} = 5{,}357 \times .3249 = 1{,}740$ lb. The total leading truck reaction is then $U = 6{,}382 + 1{,}740 = 8{,}122$ lb., the lateral component of which is $U_1 = U \cos u$, which for a 1 deg. 30 min. angle gives $U_1 = 8{,}122 \times .9996 = 8{,}118$ lb., so that the effect of this angle may also be neglected in practice.

The reaction of the leading truck radius bar center pin may be computed from the formula $V = \frac{fOd}{a}$, in which f is the coefficient of friction, .20, O is the weight on the outer leading truck wheel, 11,200 lb., $d = 60$ in., as before and $a = 80$ in., from Fig. 9. Then $V = 1{,}680$ lb. and for a 1 deg. 30 min. angle v, its lateral component is $V_1 = V \cos v = .9996\ V = 1{,}679$ lb., from which it may also be seen that the effect of this angle may be neglected in actual work.

The trailing truck radius bar center pin reaction may likewise be found from the formula $R = \frac{dfO_6}{a^1}$, in which $d = 60$ in. as before, $f = .20$, the weight on the outer wheel being $O_6 = 22{,}990$ lb. and $a^1 = 89$ in. from Fig. 9. This gives $R = 3{,}100$ lb. with its lateral component $R_1 = R \cos r$, which for a 1 deg. 30 min. angle gives $R_1 = 3{,}100 \times .9996 = 3{,}099$ lb. showing that in this case too, R may be taken for R_1.

Using the moment arms given for these reactions in Fig. 9, we find the moments of these three reactions to be:

		In. lb.
Leading truck pivot	166 × 1,679 =	278,714
Leading truck	246 × 8,118 =	2,098,028
Trailing truck pivot	171 × 3,099 =	529,929
Total of all moments		2,906,671

The difference between this total moment and the total of the resisting moments must be taken care of by the flange of the leading driver, acting through the moment arm y, or 6,812,571 — 2,906,671 = 3,905,900 in. lb. for the leading flange. If the point of contact between the flange and the rail of this driver is 3 in. ahead of the

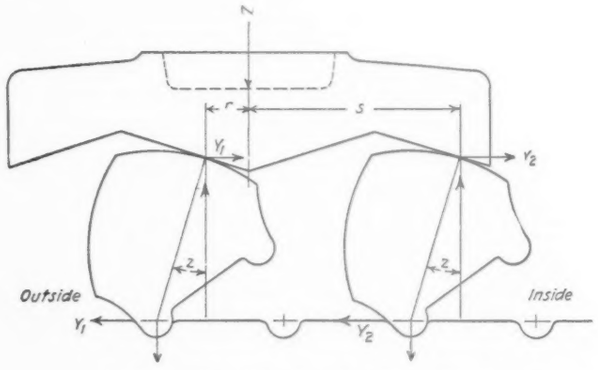


Fig. 7—Reactions in the leading truck

center of the wheel, then its moment arm is, referring to Fig. 9, 137 in. Dividing the otherwise unbalanced moment of 3,905,900 in. lb. by this arm gives 28,510 lb. as the thrust that must be produced by this flange.

Considering now the angle of incline, i, in Fig. 8 to be 80 deg., we find that the vertical component of this thrust of 28,510 lb. is $S_1 = S \cot i = 28{,}510 \times .1763 = 5{,}026$ lb. We also find that the pressure normal to the rail is $s = \frac{S}{\sin i} = \frac{28{,}510}{.9848} = 28{,}950$ lb. The vertical reaction of the friction due to this normal pressure is $s_1 = f^1 s \sin i = .35 \times 28{,}950 \times .9848 = 9{,}978$ lb. The sum of these two vertical reactions, or 5,026 + 9,978 = 15,004 lb., must be overbalanced by the weight on the wheel if a derailment is not to result. Referring to the above computation of weights on the various wheels, we find that the outside leading driver exerts a load of 22,165 lb. on the rail, which is sufficient to hold the wheel down.

The factor of wheel bearing in this case is $\frac{22{,}165}{15{,}004} = 1.47$, and as long as it is greater than 1.00, we do not need to fear trouble from the wheel climbing the rail. But .47 does not give very much of a margin and it is easy to see that it would not take very much variation in any

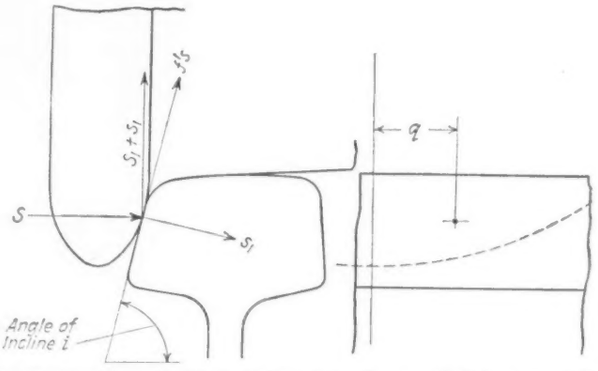


Fig. 8—Relation of the horizontal to the vertical forces at the wheel

one or more of the numerous conditions entering into this factor to bring it down to 1.00, or even lower, and thus cause a derailment. For example, a low joint may momentarily cause a reduction of weight on the leading driver—momentarily, yet just long enough to allow the wheel to climb the rail. A slight increase in elevation may do the same thing. A rail, out of line even for a short distance, may cause an added side thrust sufficient to do the trick. The locomotive may be just out of the shop, still somewhat stiff, and with the lateral taken up to the minimum, so that the binding action causes extra pressure and friction on the leading flange, the tires may still have their tool marks, which greatly increases the coefficient of friction. All of these factors tend to lower the wheel's advantage over the rail. These as well as many other conditions may be mentioned, which are contributory to the lowering of the factor of wheel bearing to the danger point of 1.00.

Benefits derived from this study

The value of a study such as this is not so much in setting forth the principles involved, or in being able ot calculate actual forces and stresses, or even in being able successfully to investigate cases of derailments and find the the causes thereof, as in being able to point out the conditions in the locomotive, track or operation which may be improved to prevent such derailments. The study is more of a means than an end in itself. So it would be well, in order to attain the desired end, to discuss some of the factors involved in the light of their effect on locomotive, track and operating conditions.

Locomotive conditions

Probably the locomotive condition which has the greatest effect in increasing the factor of wheel bearing is the lubrication of the leading flange. This lubrication makes a marked decrease in the coefficient f^1 with a proportional decrease in the vertical reaction s_1. All modern heavy

locomotives should have flange lubricators and in case of a derailment, the lubricators should be the first thing examined to see if they are working properly. Of next or nearly equal importance is the smoothness of the tire surface. We read of automobile tires that are geared to the road, and we get the same effect from locomotive tires that have finishing tool marks left on the tread due to chattering wheel lathes. A lathe should be powerful enough to take a finishing cut over the whole tread with a contour finishing tool without chattering. Of course tool marks soon wear off, yet the records show that many derailments take place with locomotives just out of the shop, on which the tires are not yet worn smooth. The pressure between the leading flange and the rail and its consequent vertical frictional and wedge reactions are not so great if the locomotive does not bind in the curve. There are several devices which may be employed to advantage in order to lessen or eliminate binding. The lateral or hub clearances may be increased on all the drivers or only on the front and rear hubs. This however, cannot be carried too far, on account of the I. C. C. limits for lateral, which require the wheels to be dropped, in case the lateral is too great. Yet the wear is greatest when the lateral is the least and even a little increase helps.

Setting the tires of the front and back wheels closer, back to back, than the others helps to lessen the binding. The use of blind tires on the main wheels, which has been assumed in this study, also helps. In addition to these remedies for binding there are also other devices, such as floating axles, which could be considered to advantage. But when such devices are used, they require a slightly different treatment of the problem of finding the factor of wheel bearing, due to the changed method of guiding, increased overhang of the leading truck, etc. It may also be observed that the coning of the treads of driving wheels has an effect on the situation. The coning soon wears off, but while it lasts, it does not act the way it should. By referring to Fig. 4 it will be seen that since the axles are held parallel to the frame and not radial to the curve, the fourth and fifth drivers have their large diameters rolling on the inner rail and their small diameters rolling on the outer rail. This is just the opposite from what we would like to have, with the result that the longitudinal slipping of the wheels is increased. The two leading drivers behave in the desired way, but since they are coupled to the others by the side rods, the effect of their good behavior is lost.

From the foregoing discussion, the benefit of the weight on the leading drivers and leading truck is apparent. These weights should be made as large as possible consistent with journal bearing pressures and rail loads. The driving wheel weight enters directly into the factor of wheel bearing and the leading truck weight enters directly into a guiding reaction which has a large moment arm and is therefore valuable. It may be observed from Fig. 7 and the discussion relating to it, that in curving an additional weight is thrown on the outer leading truck wheel, thus helping to increase its factor of wheel bearing and thus keep it on the rail. Sharp flanges are often blamed for derailments and sometimes justly, but in a case of this kind it would seem that they would be more advantageous than harmful. They increase the angle of the inclined plane between the flange and rail and thus lower the vertical force necessary to resist the side thrust. Long wheel bases, other things being equal, cause more binding in a given curve than short ones. Whether they would cause an increase in the factor of wheel bearing is something that would have to be determined for each case; for the moment arms of the resisting forces increase, at the same time the moment arms of the guiding reactions also increase, and an investigation would have to be made to determine if the one increased more than the other.

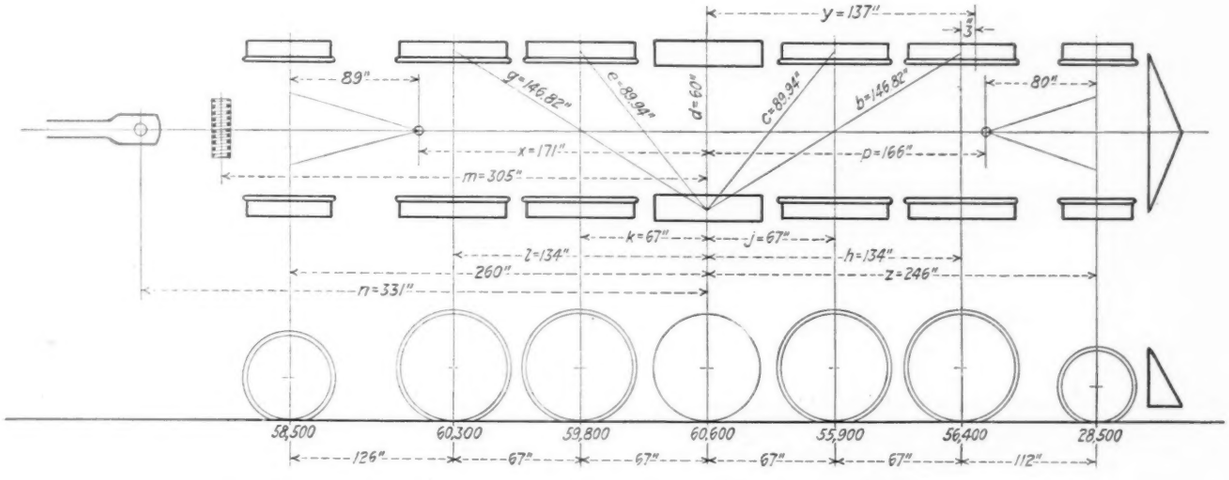


Fig. 9—The wheel loads and dimensions of a typical Santa Fe type locomotive

Mention has already been made of the resistance of the trailing trucks to curving, but these trucks become guiding trucks when backing, so that we can do no more than try to get a good compromise for the amount of their side thrust. The same is true of the leading trucks, except that the forward motion should be favored at the expense of the backward. While the effect of a booster on the trailing truck has not been taken into account in this study, such a device has a real bearing on the problem. For the traction of the booster has a lateral component which assists the curving of the locomotive by an outward thrust in forward motion.

Track conditions

The track condition having the most important bearing on the problem is probably the elevation of the outer rail. Each locomotive requires a certain particular elevation for each speed and curvature so that, at best, any given elevation is a compromise. And since heavy locomotives require little elevation at low speeds this becomes the operating problem of running these locomotives faster or the fast trains slower, or by making a compromise to the end that the elevation may be reduced consistent with safe

operation of fast trains. The elevation operates at very slow speeds, as already shown, to relieve the outer rail of weight and to place it on the inner rail. Or, in the case given, the outer leading wheel carries 22,165 lb. and the inner leading wheel, 34,235 lb. for a four-inch elevation. Now if the elevation was increased so that the outer load of 22,165 lb. were reduced to 17,147 lb., which was found to be the vertical reaction, there would be nothing to prevent the wheel from climbing over the rail. Thus we see that rail elevation is a direct factor in the problem.

Next to elevation comes the matter of curve-worn rails. The worn surface simply provides the inclined plane up which the flange, if not restrained by weight, rolls to freedom. The more curve-worn the rail, the easier the ascent and the more difficult the work of holding the wheel down.

It would seem from this study that the track gage has little bearing on the problem, provided it is great enough to prevent binding, and in order to do this for Santa Fe type locomotives, it must be a little wider than standard on curves of eight degrees or more. Mention has already been made of track surface and alinement, and of the fact that variations in these, as well as in elevation, may cause momentary disturbances in the balance of forces sufficient to cause a derailment. The general use of spiral curves is helping to relieve locomotives of the sudden side thrust when entering a curve with the consequent sudden lowering of the factor of wheel bearing, thus making for the safer operation of heavy locomotives.

Operating conditions

While it has already been stated that any locomotive should be able to be operated at any reasonable speed over any curvature for which it is suitable, and that the locomotive and track conditions should be altered if necessary to make operation safe, yet it is profitable to see what effect operating conditions actually do have on the curving of locomotives. For example, it may be difficult to persuade a locomotive engineman to "widen on her" on a curve where he may have been on the ground the trip before, yet we must conclude from the study of the problem that an increase in speed helps reduce derailments, for not only does the coefficient of friction decrease with the speed, but also the effect of centrifugal force begins to be felt in helping to hold the outer wheel down. This deduction is borne out in practice. Locomotives that derailed at a particular place and a certain speed were found to traverse the place safely when the speed was increased. The use of steam and brakes also has some effect, for it has been found that locomotives will sometimes drift around a curve when, at slow speeds, the use of either steam or brakes would cause the wheels to tend to line up against the lateral, apparently increasing the binding and friction. Reference has already been made to the beneficial use of the booster on curves, the use of steam just mentioned not being intended to apply in the case of the booster. Reference has also been made to the reduction of the elevation which may be permitted by decreasing the speed of high-speed trains on curves that are giving trouble with heavy low-speed locomotives.

Summary

In order to grasp the situation as a whole, let us summarize the conditions which make curving easier and derailments fewer. In making changes, each of these conditions should be considered in the light of other related conditions, and the changes made should always be consistent with safety of operation and economical maintenance. These conditions are:

In the locomotive—
- Flange lubrication.
- Smooth tire and flange surfaces.
- Increase in hub clearance.
- Decrease in gage spacing of tires.
- Use of blind tires on main drivers.
- Use of floating axles.
- Decrease in coning of wheel treads.
- Increase of weight on the leading drivers and engine truck.
- Decrease of the trailing truck's side thrust.
- Increase of leading truck side thrust.

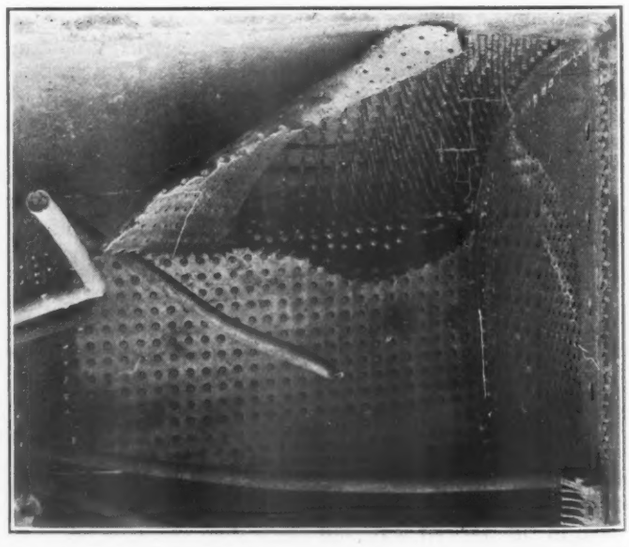
In the track—
- Decrease of the elevation of the outer rail consistent with the safety of high-speed trains.
- Removal of curve-worn rails.
- Maintenance of good service.
- Maintenance of good alinement.
- Widening of the gage on curves to prevent binding.

In operation—
- Judicious use of speed on curves.
- Drifting around curves.
- Use of booster on curves.
- Reduction in speed of high-speed trains to permit some elevation to be taken out of the track.

This method of analysis may also be used for the investigation of the factor of wheel bearing of the leading truck by assigning a calculated value to the side thrust of the leading driver and solving for the vertical reaction of the leading outside truck wheel. It may likewise be used for the investigation of derailments of either drivers or trailing truck wheels when the locomotive is running backward.

New Santa Fe locomotives for the C. N.

An article by C. E. Brooks, Chief of Motive Power, Canadian National, describing the new Santa Fe type locomotives recently purchased by that road, was published in the December, 1924, issue of the *Railway Mechanical Engineer*. It was stated in the title of this article that these locomotives were the largest of their type in the world. This statement is incorrect. While these locomotives are of exceptional weight and tractive force, there have been a number of others of the same type built which are of heavier weights and larger capacity, examples of which are those built for the Baltimore & Ohio and the Great Northern. The author of the article was not responsible for the incorrect statement.

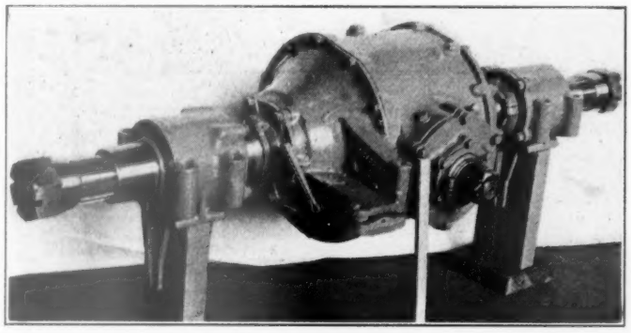


Failure of a portion of the flue sheet, crown sheet seam and side sheet seam which had been autogenously welded

Motor car of large capacity

Brill coach has seats for 59 and will haul a trailer seating 60 additional persons

THE J. G. Brill Company, Philadelphia, Pa., has designed and built a large gasoline motor-driven passenger coach which has a maximum seating capacity of 59 and will haul a trailer with an additional seating capacity of 60. The car, designated by the builder as its Model 75, is driven by a six-cylinder motor which develops 190 hp. at 1,300 r.p.m., the power from which is

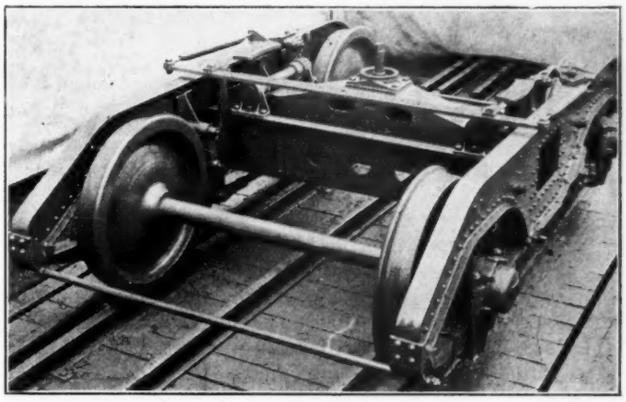


One of the axle gear cases, with the torsion spring seat showing at the left side

delivered through a transmission of unique design to both axles of the forward truck. The motor is mounted at the forward end of the car body.

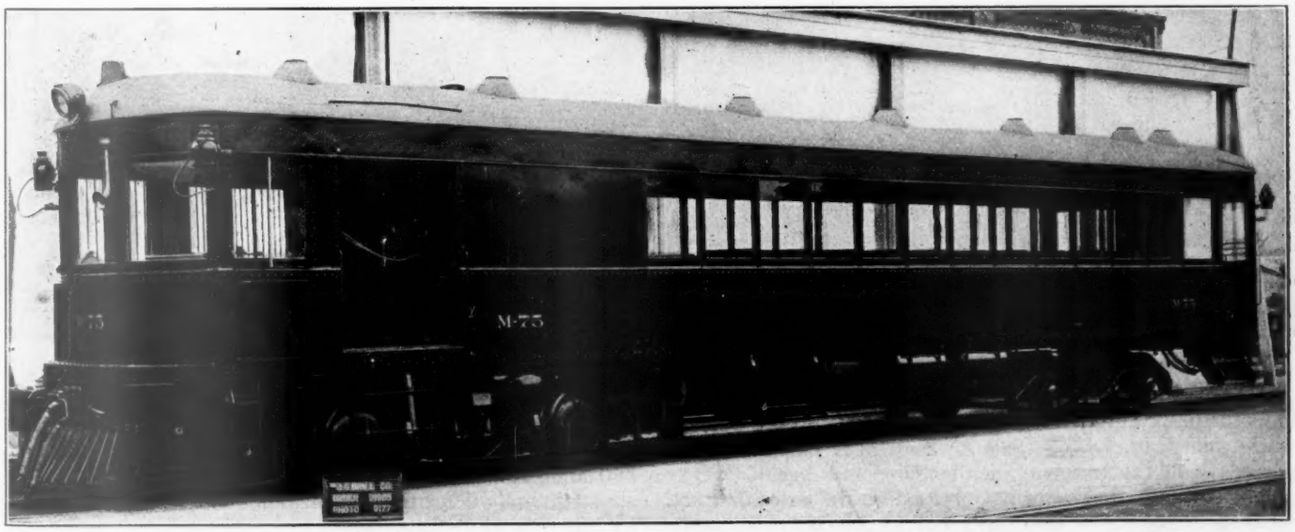
The transmission is of the drop shaft type. It was specially designed to take care of the powerful motor with which the car is equipped and is particularly noteworthy because of the fact that it is built into the bolster of the forward truck. One of the illustrations shows this bolster removed from the truck. The driving shaft from the engine is coupled through suitable universal and slip joints to the upper part of the two projecting shafts. This shaft is carried through the bolster and a shaft drive is taken off from the rear end for the operation of the air compressor. The lower of the two projecting shafts is connected at each end with a driving shaft leading to the gear case of the adjoining axle. This construction has materially reduced the normal angularity of the driving shaft from the engine and has practically eliminated the angularity from the shafts leading from the transmission to the axles.

This transmission provides five speed ratios, two of which involve the countershaft which is located at one side of the transmission output shaft. These two speeds are used only in starting and accelerating the car. For the remaining three speeds, the countershaft is idle and, as they operate at the same efficiency, each may be used as a running speed according to the requirements of grade and



The trailer truck

load conditions. The gears for the fourth and fifth speeds, the faces of which always maintain a fixed relation with each other, are of the spiral type. The gears for the lower three speeds, owing to the sliding relationship which must be maintained, are of the straight tooth type. All gears, however, are always in mesh, the changes being made by means of jaw clutches. Ball bearings are used throughout for all of the shafts and are also provided



The Brill Model 75 motor car—length, 55 ft.; weight, 53,000 lb.; seating capacity, 59

between the driving shaft and the gears which run idle upon it.

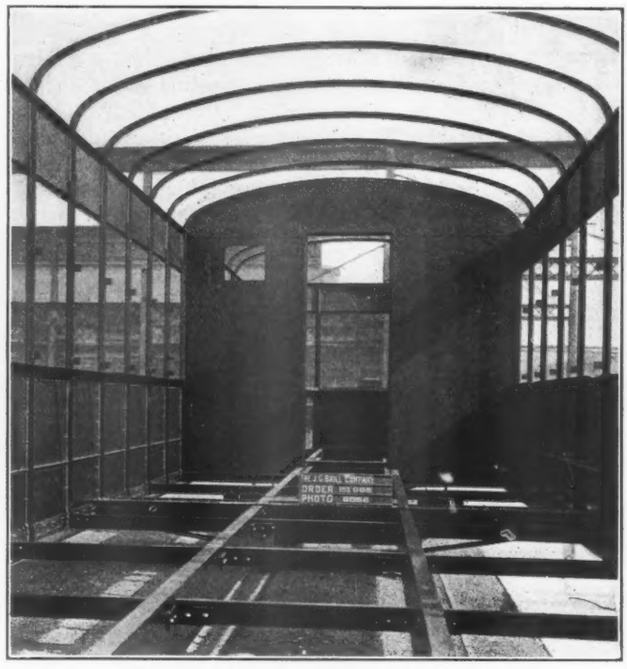
The transmission always runs in one direction. The reverse is provided in the axle gear case, the bevel driving pinion meshing with two bevel gears, one or the other of which is connected to the shaft by a double clutch. The car may thus be operated with equal efficiency in either direction. The connections from the gear shift and reverse levers have been so designed that they compensate for the angularity of the trucks on curves.

Both power and trailer trucks are generally similar in

The driving truck bolster—The figure is touching the gear shift arm

design. In the power truck, however, the side frames and journal boxes have been placed inside the wheels, while in the trailer truck they have been placed outside the wheels.

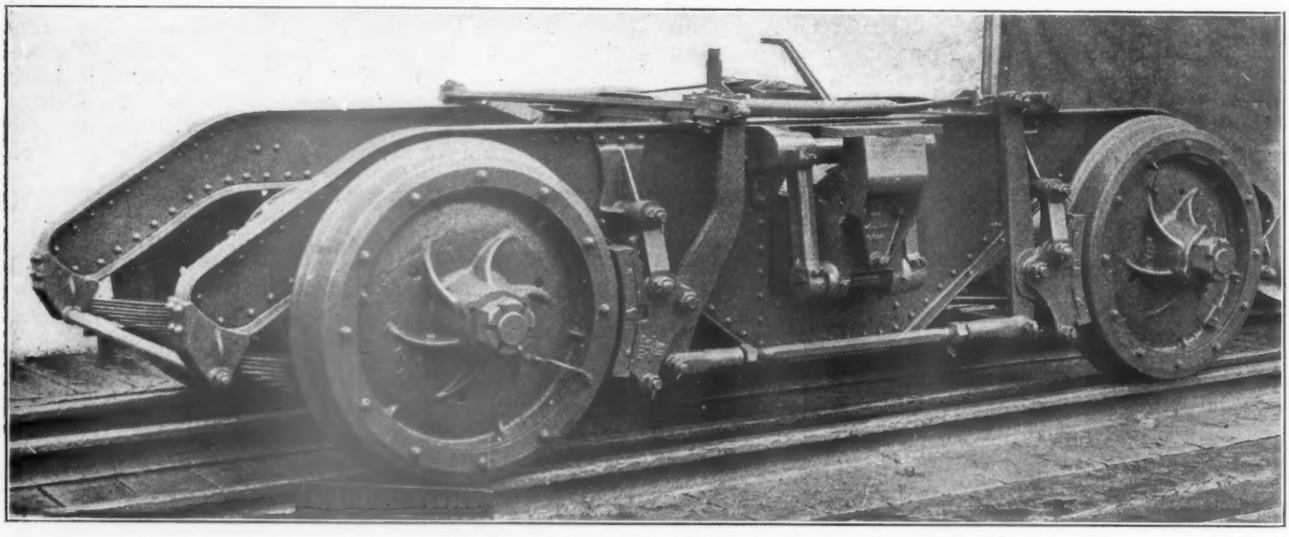
The side frames of both trucks are built up of double plates with the T-section flanges and fillers and stiffeners riveted between them. The axle suspension follows automotive practice in that the journal boxes are secured directly to the centers of the semi-elliptic springs. The bolsters of both trucks are supported on swing links. The



The body and underframing of the Model 75 car

steel and are fitted with Timken taper roller bearings packed in grease. The wheels are of rolled steel, 33 in. in diameter, with M. C. B. flange and tread contour.

The motor is of the six-cylinder, four-cycle type, with 6-in. by 7-in. stroke. The size of the valves has been



The driving truck with inside journals

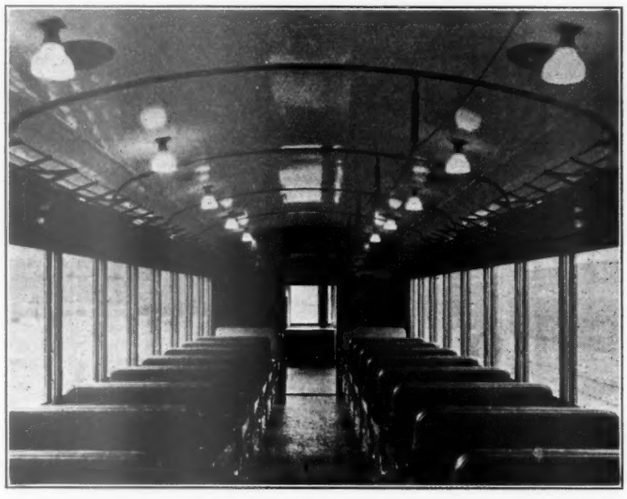
links of the power truck are secured directly to the outside of the side frame, while those of the trailer truck are supported from the transom members.

The driving wheels are not pressed on the axles, but are secured by means of two taper collets which are securely clamped between the wheel fit and the axle when the nut on the end of the axle is drawn up. The torque is delivered to the wheels through a spline connection on the axle between the inner ends of the collets. This arrangement permits the wheels to be readily removed with a special puller when the removal of the axle from its gears becomes necessary. The axles are of heat treated alloy

kept down by using two intake and two exhaust valves for each cylinder. The engine develops a torque between 780 and 800 lb. ft. from a speed range of 500 r.p.m. to approximately 1,200 r.p.m., dropping off at higher speeds to approximately 740 lb. ft. at 1,500 r.p.m. The horsepower ranges from 75 at 500 r.p.m. to 150 at 1,000 r.p.m.;

190 at 1,300 r.p.m., and about 206 at 1,500 r.p.m. The fuel consumption per brake horsepower from 800 to 1,300 ranges between .5 and .6 lb. The engine drives through a multi-disk clutch of large diameter, fitted with a clutch brake which facilitates bringing the heavy driven parts into proper speed relationship for the operation of the gear shift. This clutch, the propeller shafts, the transmission and the axle gear housing, while developed along the lines of automotive practice, are of special designs larger than stock types, to take care of the heavy power transmission involved with minimum of maintenance or operating difficulty.

The engine is fitted with a starting motor operating



Interior of the coach, looking toward the baggage room

through a Bendix drive, a 12-volt generator of 1,000 watts capacity, two carburetors, two ignition systems, one a Delco distributer and the other an Eisemann high tension magneto, and a centrifugal pump driven water cooling system, the radiators of which are fitted in the front end walls of the car. All mechanical equipment involved in the driving of the car is included as a part either of the motor unit or the driving truck. Either or both of these units may be removed from the car and replaced within the duration of an ordinary lay-over period.

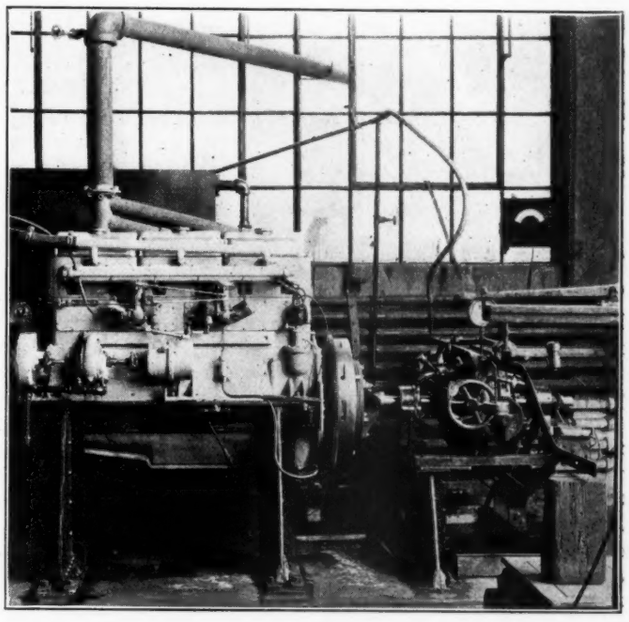
The car body is built to dimensions which closely conform to those of standard steam passenger equipment. The underframing consists of two 10-in. channel center sills which extend the entire length of the car body, angle side sills, built-up body bolsters, a diaphragm cross-tie at the center of the car and numerous floor supports. The body structure includes a frame of light T-section posts to which are riveted the outside steel side sheets and letter board. Carlines of sections similar to the posts support the roof, which is of wood covered with canvas embedded in white lead. The partitions between the baggage room and passenger compartment and between the passenger compartment and the vestibule at the rear are of steel plate riveted to a light weight framework of structural steel.

A feature of the inside finish of the car is the method of guiding and retaining the single bass window sash. This is accomplished by the use of Grill patented brass post casings which grip the sash with a sufficient spring action to prevent rattling. The sash are removed or replaced by springing back these casings and no removable window stops are required. These casings, designated by the trade name of Renitent, were primarily developed for use on street cars. The doors, casings and moldings are of dark stained mahogany, the ceilings are finished with Agasote and the side lining below the windows is of mahogany faced Haskelite ply wood.

The car body has a total length over ends of 55 ft. The baggage compartment, including the hood for the engine, is 16 ft. 3 in. The passenger compartment is approximately 34 ft. long and the rear vestibule is approximately 4 ft. long inside at the center. Access to the baggage room is obtained through 4-ft. door openings on either side of the car and the vestibule doors have a clear opening of 2 ft. 5⅝ in. The vestibule is entered by means of four steps on either side, the openings over which are closed by Edwards trap doors. The seats in the passenger compartment are furnished by the builder of the car. They are of the stationary type for two passengers each and have aisle arm rests. With this arrangement there is a clear aisle space of 30 in., which is large enough to permit the use of seats wide enough for three passengers on one side and two passengers on the other by using a type from which the isle arm rests are omitted.

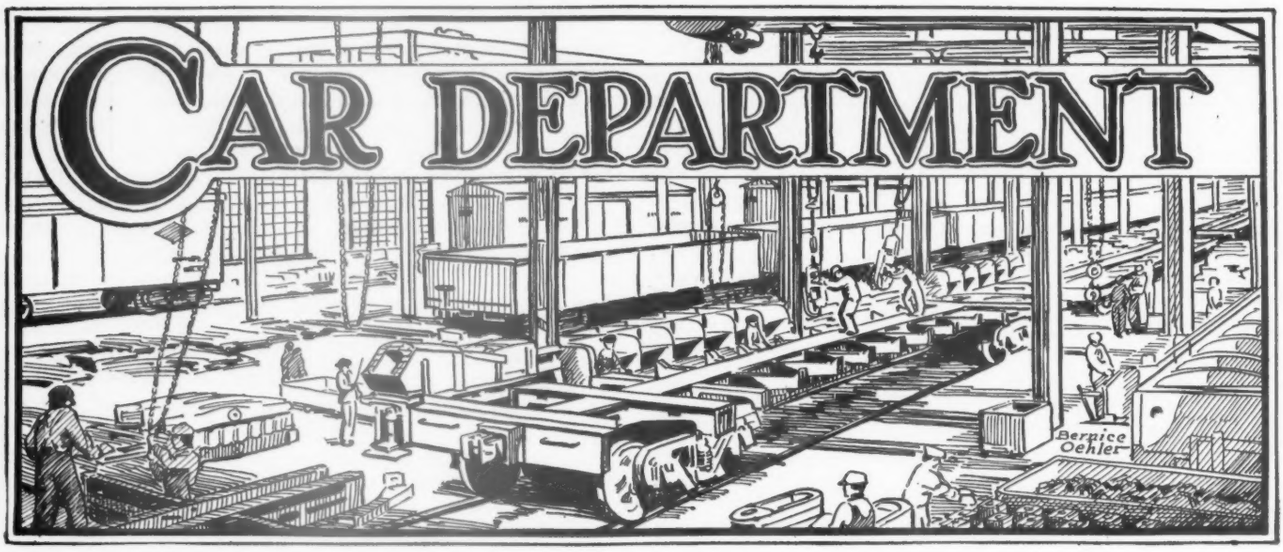
The interior photograph shows that the car is fitted with continuous parcel racks on each side of the passenger compartment and with 12 lights mounted on the ceiling, 6 along either side of the car. A saloon at the rear end is fitted with a dry hopper and a Giessel drinking water cooler. The car is heated by a Peter Smith hot water heater installed at the rear end of the baggage room.

On a trial trip recently made with this car, the car without trailer demonstrated its ability to accelerate up to 25 miles an hour at the rate of one mile per second.



The motor of the Brill Model 75 car on the testing block

Operating at the recommended engine speed of 1,300 r.p.m., the car develops a speed of approximately 59 miles an hour in high gear, 49 miles an hour in second gear, and approximately 24 miles an hour in third gear. As these three speeds are all direct drive, they are equally available for running and permit the handling of the trailer at the lowest of the three speeds on grades a little steeper than 1¾ per cent. Without the trailer it is calculated that the engine will be capable of maintaining the maximum speed in high gear on grades up to approximately 1 per cent and that it will maintain the lowest of the three direct drive speeds on grades of considerably over 3 per cent. The maximum speed may be maintained with a trailer on light grades up to about 0.35 per cent.



Improving car department service*

An interesting discussion of the methods which tend to make the "Milwaukee" car department an unusually effective organization

By L. K. Sillcox

General Superintendent of Motive Power, Chicago, Milwaukee & St. Paul, Chicago

Part I

SERVICE, such as implied in the title of this address, is dependent on an adequate organization, properly selected, adequately directed and constantly followed up. The elements involved are both human and material. In the first place, it is understood that each administration has its problems presented in a way peculiar to itself, so that any suggestions for change ought to be carefully weighed and, if found at all desirable, modified or improved upon to fit the actual condition in mind, then woven into the policies already obtaining, to the extent found most favorable to an enlargement and betterment of existing methods. Changes are hardly ever profitable, if hastily carried out; confusion and distrust are avoided if time is taken to consult with and receive suggestions from those directly affected.

A great deal of pressure is brought to bear from certain sections for even larger management units than we now have and yet the dangers of such a move are not often thought of and even less evidently expressed. There are those who urge more extensive railway grouping, those who feel that all of the freight cars in the country should be constructed, operated and maintained by one single organization and quite a number of other propositions similar in purpose, which are brought to attention from time to time. It is important in every circumstance where judgment must be passed to seek fundamental facts and principles. The aim should be, in any event, to preserve the personal equation and if large management groups can be so skillfully conducted as to meet this need, much of possible danger is avoided. Again, attention is directed to the thought that in any endeavor where individual initiative is lacking or conditions make the exercise of it unimportant, we are sure to travel in a negative direction. Competition is a necessity either in business or for a healthy sense of personal merit.

The one great thing that keeps the railroad service of our country to the present standard it has attained, even though some properties are not able to operate on a paying basis, is the element of attainment; still the public reaps the benefit. There is a fact to be reckoned with in our daily life as railroad men which cannot be expressed in dollars and cents. It is given freely, wholeheartedly and constantly—an ever living pride in the operation of the railroad each of us may be privileged to serve. I hesitate to bring so much data from the administration I am connected with, but if it is accepted as a few leaves from our book of experience and never in the sense of self-satisfaction, I shall feel some good has obtained. In addition let me say that such presentation as is made should be credited to the faithful support accorded by my associates.

Car design

It is necessary to adapt the question of car design to service (regardless of territory) with the object of having equipment which will give a maximum of return with a minimum of delay because of not being in the proper condition. The question of car design is ever progressing in that there is a rather constant advance in the methods of

*Abstract of a paper read at the regular monthly meeting of the Car Foremen's Association of Chicago, held December 8 at the Great Northern Hotel, Chicago.

operation as well as *universal* and *interchangeable* use, which must be kept pace with in the design of equipment. For the past 15 years there has been a considerable increase in the size and tractive force of locomotives in order to meet the demand for larger individual trains and thus reduce the unit cost of train and engine crew expense per ton mile. This has brought about a demand for freight equipment which will meet the changing conditions so that there has been a very marked enlargement in thought regarding the matter of strengthening parts, especially in the body bracing, underframing, draft members, etc. In common with other carriers our experience shows that these conditions generally develop into a demand for a plan of work or a program of improvements to freight cars such as will cause the major portion of ownership to be universally acceptable as to strength requirements and protect the owning road in current maintenance expense. For this purpose an analysis of the affected by the policy of the carrier, for some 20 years previous, as to the rate of turnover in acquiring new and retiring old equipment.

Improvement program

It can be said, in general, where there has been a steady and accurate retirement program with an acquisition factor designed to offset the same, that it forms one of the easiest methods of overcoming obsolescence in design, but where retirements have been deferred with a consequent lack of new equipment acquired, the problem of overcoming obsolescence or the inherent design of equipment which does not permit of maximum service, is one involving large proportions and a great deal of expense when a change in policy is forced by reason of expanding service demands. Such a condition usually requires years to overcome. It is necessary to analyze each series of cars and determine what improvements or changes are

SCHEDULE REPAIR PROGRAM — PROGRESS REPORT — MONTH OF OCT. 1924

Schedule	Series	No. Cars Owned 1st of Month	Cars Retired During Mo.	Cars Owned end of Month	Total Cars Completely Overhauled to 1st of Mo.	Total Completely Overhauled This Mo.	Total Completely Overhauled to end of Mo.	Cars remaining to overhaul to end of Month	No of Cars Covered by AFE to Completely Overhaul	No of Live AFE	No of Cars remaining to cover by AFE to be Complete Schedule
1	51900-68198	2476	None	2476)							
1	68300-69524	155	None	155)							
1	70526-72524	293	None	293)	4102	None	4102	None	4102	None	None
3	72526-81478	2948	4	2944	535	11	546	2395	1500	5624-8968-9685	1444
4	87484-93480	2888	None	2888)							
4A	81482-83480	947	None	947)							
4	500000-506204	6017	None	6017)	3355	61	3416	6436	6000	8966	3852
5	83482-87480	1860	None	1860)							
5	200000-206499	6084	None	6084)	6794	22	6816	1128	7948	7256	None
7	700000-703999	3989	None	3989	2	None	2	3987	None	None	3987
9	506205-508204	1968	None	1968	None	None	None	1968	None	None	1968
10	590000-590249	247	None	247	None	None	None	247	None	None	247
16	206501-207470	914	None	914	650	37	687	227	914	8251	None
23	735-2999	631	None	631)							
23	8149	1	None	1)							
23	8425	1	None	1)							
23	8267-12999	1059	None	1059)	None	1	1	1691	25	11395	1667
24	10000-102499	2354	None	2354	None	None	None	2354	None	None	2354
27	68695-68999	152	None	152)							
27	43001-45285	1073	None	1073)	None	None	None	1225	None	None	1225
27A	15001-15671	140	None	140)							
27A	26001-29675	757	None	757)							
27A	47401-47999	198	None	198)	None	None	None	1095	None	None	1095
29	32259-37257	2464	None	2464	None	None	None	2464	None	None	2464
31	29677-32075	1115	None	1115	None	None	None	1115	None	None	1115
32	300000-302499	2410	None	2410	1795	16	1811	599	2089	9918	321
34	25493-25891	169	None	169	169	None	169	None	169	None	None
39	48101-49999	693	None	693)							
39	70001-70969	348	None	348)	None	None	None	1041	None	None	1041
42	01-0767	418	None	418)							
	0870-01340	311	None	311)							
	01388-01453	39	None	39)	9	3	12	756	40	11647-12417	728
	Total C.M.&STP.	45119	4	45115	17411	151	17562	28731	22787		23508

Fig. 1—Schedule repair program—progress report based on detail reports confined to location

equipment owned with a view to determining that which has not been giving the proper service or which could not be brought up to operating demands is imperative and can usually be divided into:

(1) Those cars built of recent years which are of such design as to practically meet present conditions with maximum service.

(2) Those cars which have been built prior to the operating change referred to, but which could not be dismantled consistently because of age, general design and capacity and, therefore, which can be made subject to a special improvement program on the basis of a study of physical characteristics.

(3) Those cars which because of age, capacity, design and condition are not considered fit to be improved and, therefore, can be run until worn out and then dismantled.

The second item was found to embrace from 25 to 35 per cent of the total equipment in our case, and was required to make them fit for maximum service, then to work out a bill of material and labor schedule for each and determine the total cost. As a matter of convenience this plan is easily followed if each class of car is given a schedule number, the schedule representing the bill of material and amount of work to be done.

A program of this kind involves the selection of car shops best adapted to each kind of work with a corresponding organization of forces, stock of material, shop facilities, etc. The location of shops in the vicinity of loading stations is a factor of importance with respect to economy in transportation. Considerable supervision of such work is required to see that material is at hand to keep forces fully employed and that the work is done as prescribed and the output is at the proper rate. It is possible to set up a definite output based on a specific number of men allotted for the work at each point and then keep a definite record of the work done so that the

status of same may be known at all times. An illustration of the manner in which it is possible to follow the general work, based on other reports of greater detail and confined to location, is given in Figs. 1 and 2.

In any such plan there is, of course, a great deal of heavy work done in the nature of repairs in kind and in many cases it can be determined by estimates before the work is done, whether or not it will constitute rebuilding as prescribed by an accounting method or will be considered as heavy repairs with certain charges to capital account for improvements. This is merely another expression of the fact that obsolescence is overcome to the degree that equipment when reinforced to meet present day strength requirements is accounted for in the books as new and the expected life cycle will be relatively extended. Freight car repairs, if carried on so as to give maximum car service at a minimum cost, usually result in dividing the work into two groups; that is, the repairs which must be made at certain frequent intervals to overcome wear of certain parts, and repairs which are naturally accumulated until the heavy repair cycle is at hand. All carriers renew, by force of circumstances, such items as wheels, axles, brake shoes, brasses, air-hose, couplers, etc., in their proper cycle between heavy repairs to the entire car. This is a natural sequence, if maximum service is to be obtained with a minimum repair cost and at the same time having the situation in control as to developments which require further improvements.

The turnover of equipment both in the matter of retirement, acquisition, rebuilding and heavy repair work is a very important feature in developing car repair programs and especially in determining the policy to be pursued after an analysis along this line has been made. For instance, the average age of equipment owned, while a vital factor in the proper knowledge of the repair situation, has not, for the most part, accurately reflected conditions as to requirements of policy with respect to physical factors on such roads as are subject to Interstate Commerce Commission accounting rules, as was the case prior to 1914. In that year the I. C. C. issued a classification of accounts, providing that the rebuilding of equipment in cases where the cost of the work constituted the major portion of the value be considered as renewed, and as this required calling equipment new under such circumstances, the life cycle was for this reason begun anew. This changed the situation considerably in the case of some administrations from their former practice, because prior to that time the life cycle of the car continued from the original date built regardless of the nature of the ensuing repairs or improvements and it was entirely optional with the owner whether or not it would be considered that cars were dismantled and used in building up new equipment or whether the original unit would be continued, as such, regardless of the work done. The requirements of the I. C. C. classification covering rebuilding made it possible for those who elected to do so to adopt a policy of refinancing and reconditioning equipment out of operating expenses in the first instance with a consequent adjustment of accounts and transfer of proper charges to capital account, all of which has generally been affected by the operating ratio as a determining factor in the extent to which the rebuilding of equipment could be carried out. In recent years, however, it has been found that other administrations have been able to borrow money on the new valuation of rebuilt equipment because, presumably, they could not bear the operating charge in the first place, even though this would eventually be credited to operating expenses and charged to capital.

EXHIBIT NO. 1A

SCHEDULE WORK ON CARS

September 1924

Location	Schedule No. 3 Series: 72526-114?8 Kind: Box No. Cars Owned 2945 Completed This Mo.	Schedule No. 4 Series: 67681-93450 Kind: Box No. Cars Owned 5905 Completed This Mo.	Schedule No. 4A Series: 81482-83480 Kind: Box No. Cars Owned 947 Completed This Mo.	Schedule No. 5 Series: 81482-83480 200000-206498 Kind: Box No. Cars Owned 7944 Completed This Mo.	Schedule No. 16 Series: 206591-207470 Kind: Auto No. Cars Owned 914 Completed This Mo.	Schedule No. 32 Series: 300000-302499 Kind: Gondola No. Cars Owned 2410 Completed This Mo.	Schedule No. 34 Series: 25495-25891 Kind: Ore No. Cars Owned 169 Completed This Mo.	Totals
				C M & St P				
Lines East								
Minneapolis	-	-	-	1	-	-	-	1
Chicago	-	-	-	-	-	6	-	6
Milwaukee	9	25	3	20	24	-	-	81
Dubuque	-	-	-	-	-	-	-	-
Green Bay	-	-	-	-	-	-	-	-
Total This Mo.	9	25	3	21	24	6	-	88
" to date	301	1388	*	4074	384	1695	169	8011
Lines West								
Deer Lodge	-	9	1	-	-	-	-	10
Tacoma	-	11	4	-	3	-	-	18
Total This Mo.	-	20	5	-	3	-	-	28
Total to date	234	1968	*	2720	289	100	-	5291
System								
Total This Mo.	9	45	8	21	27	6	-	116
Total to date	535	3356	*	6794	673	1795	169	13302
Total to be Overhauled	2413	6496	*	1150	261	615	-	10935

*Schedule 4 and 4A work being done on one A.F.E. Figures for Total Lines East Total West, Total System to date and total to be overhauled for schedule 4 includes Schedule 4A

#Total to date lines East, Schedule 5 and 32, includes 969 and 749 cars respectively, completed in contract shops.

Location	C T H & S E Schedule No. A Series: 2501-2949 5051-5150 Kind: Coal No. Cars Owned 1701 Completed This Mo.	Schedule No. B Series 6500-6999 Kind: Coal No. Cars Owned 445 Completed This Mo.	Schedule No. C Series: 11000-13180 Kind: Gondola No. Cars Owned 2114 Completed This Mo.	Schedule No. D Series: 7000-7899 Kind: Hopper No. Cars Owned 892 Completed This Mo.	Schedule No. 1-A Series: 101-350 Kind: Box No. Cars Owned 187 Completed This Mo.	Total
Terre Haute	3	-	25	-	-	28
West Clinton	-	-	-	-	-	-
Bedford	-	-	-	-	-	-
Chicago	-	-	-	-	-	-
Ill.Car & Mfg.Co.	-	-	-	-	-	-
Total This Mo.	3	-	25	-	-	28
Total to date	1624	440	638	887	-	3589
Total to be overhauled	77	5	1476	5	187	1750

BOX CARS	40 ton box cars being converted to skeleton log flats at Tacoma.	40 ton box cars being converted to new ordinary log flats Milwaukee
No. of cars completed to December 1st.	200	192
No. remaining to convert	50	58
	250	250

Office of Master Car Builder

Fig. 2—Monthly report of schedule repair work by stations

Rebuilding programs must be carefully developed

The extent to which rebuilding and heavy repair work is carried on is very important. Heavy repair work can be reduced to a formula so far as requirements are concerned when an analysis is made of equipment to determine its physical characteristics on a broad scale and then set up the heavy repair cycles. These cycles run from 8 to 12 years, depending upon the characteristics of the

equipment. If a carrier owning 100,000 cars has had a turnover of rebuilding and heavy repairs at the rate of 10,000 cars per year, then it is apparent that the general overhauling cycle runs about 10 years. A more detailed analysis will doubtless develop certain cars requiring renewal cycles of eight years, others considerably more than that. The idea here is that a close regulation of the nature of repairs and, therefore, the general maintenance cost will finally resolve itself down to what is now being done in the case of locomotives, where there is a constant analysis required to determine the proper balance between running and classified repairs based on many considerations, one of which might be pointed out here as being the miles run out and miles restored in classified repairs. In the case of freight cars, years might be substituted for miles, considering years run out and years restored in overhauling. Much can be done along the lines of determining frequency of heavy repairs in further detail by records showing how this is progressing by types or series of cars. Returning again to the example of a road having 100,000 units, the following division is possible:

Cars		Age	
10,000	at	2 years	20,000
15,000	at	5 years	75,000
10,000	at	8 years	80,000
20,000	at	10 years	200,000
10,000	at	18 years	180,000
5,000	at	20 years	100,000
10,000	at	25 years	250,000
10,000	at	26 years	260,000
10,000	at	27 years	270,000
100,000			1,435,000

Average age, 14.35 years.

The policy of heavy repairs and rebuilding the past 10 years shows the average yearly number of cars so overhauled at 5,000 per year, or once every 20 years. The new program will require, after an analysis of equipment, an average of nine years between heavy work, so that the program will have to be increased to 11,111 cars per year, of which 5,000 will be rebuilt and thus renew the life cycle, and reduce the average age gradually to approximately 10 years, if the usual 20-year life is to be maintained.

But if an acquisition program is followed consistent with ownership, then there will be 5,000 cars retired and 5,000 new cars purchased, which will reduce the requirements for rebuilding to less than 11,111 cars, because of reducing the average age thereby. In the latter plan there will be an approach to the average age of 10 years but further analysis will be required to determine the extent of heavy work to be done to prevent the overhauling of obsolete cars to maintain the proper ownership complement.

Capital charges for rebuilt cars

It may be of interest to note further that the extent to which this kind of work can be transferred to capital charges is not always simply governed by the physical valuation in relation to capital investment, but as before stated, by the operating ratio, which is another way of stating that the amount of property required to perform the service is not, in every instance, the only factor, but the density of traffic as a whole or the volume handled which justifies building up capital out of operating expenses on the one hand, and direct capital charges by means of acquisition of new equipment on the other hand. Factors of this nature must be known and analyzed if a further and proper regulation of equipment is to be had consistent with local conditions, and any study will reveal the fact that at the present time there appears to be some difference in policy between carriers in this respect. Therefore, it is not possible to express specifically a general plan for common use. This is one of the reasons why the situation is not yet propitious for the central control of all the equipment in the country as a whole. Whether desirable or not, it will be many years before this problem can be fully solved and brought to a state of uniformity throughout the country. What makes this question of such great importance is that the maintenance of freight cars involves not only repairs, but includes charges for depreciation on the investment in existing cars and retirement charges (or deferred depreciation) involved in cars taken out of service. This is one of the cases in railway accounting where maintenance carries the burden of the investment, the only item eliminated being interest on investment, which is a fixed charge not included in maintenance.

While a schedule of improvements is an essential feature of any railroad policy in order to meet changing conditions in operation, there are other factors in the ordinary maintenance of equipment, such as painting programs, special attention to refrigerator equipment, repairs and inspection to permit selection of cars for specific loading, so that loads may move to destination without interruption, etc. In order to follow up a maintenance policy closely and have it regulated in accordance with what the revenues will permit, it is necessary to be able to decrease or increase special program work accordingly and also regulate other plans in maintenance policy such as inspection, light repairs, etc. [As an illustration of a rather close supervision of the various kinds of work at hand, Mr. Sillcox here presented quarterly freight and passenger car repair bulletins outlining the plan to be followed for three months and regulating the work to be done according to what conditions will permit.—EDITOR.]

Classification of inspection

Freight car inspection can be organized and classified so as to reduce the method of reporting thereof to a system rather complete in itself because carriers are not only concerned with their own repair policies, but must inspect both system and foreign cars for safe movement in trains whether the load originates on home or foreign lines.

In general, inspection may be divided between that required in the interchange of cars among railroads and that required to make the movement of trains safe over the handling line. Interchange inspection is standardized more or less under A.R.A. regulations, but it is within the province of the individual carrier to develop methods of freight train inspection with a view toward uninterrupted service. Some lines divide their freight train inspection into a number of groups, possible three classes, designated as numbers one, two and three, and have grouped their inspection forces accordingly, based on considerations of business demands and expenses.

The so-called inspection number one can be considered as that given to trains at larger originating terminals and to cover not only the condition of the equipment, but the manner in which the loads are to be placed and to enforce existing rules with the object in mind of having continuity of movement obtain. Inspectors at these points can be impressed with the importance of having loads in condition to move to destination without additional expense to shipper or carrier. Such inspection can cover the acceptance for service of all necessary items such as wheels, axles, journal packing, draft gear and brake rigging, body, trucks, etc. Special attention is often insisted upon to the body when cars are inspected initially to be placed for loading or for moving empty into territory originating freight subject to damage. This often involves the changing of wheels, etc., particularly in the case of stock cars before movement to loading territory. Close attention can also be given to safety appliances. An organization to carry out a plan as mentioned, can be

stated as consisting of two ground men, one roof man and two follow-up men, covering a string of cars from one end to the other, but when time is the ruling factor, two such gangs can be placed on one string, each working towards the middle from opposite ends. Such an organization may be provided for at terminals where there are approximately 2,000 loads and 900 empties or more moved each 24 hours. The organization for inspection depends upon the number of cars handled and the nature of traffic.

Inspection number two can be provided for at intermediate terminals at distances ranging from 150 to 300 miles from terminals where class one inspection is given. It may be applied at division points and smaller originating or interchange stations. The work covering the checking over for safe movement such items as wheels, axles, brake rigging, journal packing, draft rigging, safety appliances, air brakes, etc.

Class three inspection may be given to trains inbound or outbound at points after having received number two inspection at a distance of approximately 300 miles. The spacing of inspection stations, of course, depends upon the layout of the railroad. Inspectors can be stationed at points where they are in a position to observe trains moving into yard, looking for defects on wheels, brake connections, journal boxes, draft rigging and safety appliances. There should be a clear understanding in the matter of inspection as to what it means to "bad order" cars, and have them switched to repair tracks in cases where it would be possible to make repairs in the train yard. Switching is expensive and should be conserved, even though it is not charged to freight car repairs. Much can be done to save this expense and expedite the movement if handled in train yards.

While all that has been said relates to action which may be taken by car department employees, the element of possible loss to the service from lack of attention in avoiding cases of rough handling, cornering of cars, failure to release air brakes in making stops prior to taking siding for an opposing train, resulting in pulling out drawbars, and delaying both movements, etc., such losses may be avoided by proper co-operation and adequate appreciation in working out a plan in any given instance, for it is evident to most car men that losses of this character occur too frequently and that they are not sufficiently enumerated. A poor crew can generally manage to set out a few cars each day or burn off a journal occasionally, while it takes a wide awake and experienced train crew to treat boxes in such a way as to bring all of their cars safely into the terminal or save fuel in seeing that side doors on box cars, when picked up, are properly closed, not leaving the job entirely up to the other fellow or even overstraining themselves in these acts of constructive helpfulness. Laxity in practice has resulted from technicalities being applied, such as car men being called, in many cases unnecessarily, to couple hose, incurring expense entirely out of proportion to the work thus performed and which, for the most part, seemingly could not have been originally anticipated or even implied in the formulation of schedule rules. I recall a condition resulting from orders being issued requiring car men to scrub out cabooses which resulted in the men involved seeking information as to possibility of eventually being assigned to "redcap" duty in train yards. While the thought expressed may seem remote it clearly indicates the trend of mind on the part of car men who may be diligently applying their efforts in the interests of the service.

Qualifications and examination of inspectors

The requirements are that an applicant for a position of inspector must be thoroughly conversant with methods of car repair and construction, be between the ages of 21 and 45, must pass examination for sight and hearing, must be able to read and write, must answer 75 per cent of the 24 questions usually covered in the examination and, if he fails the first time, will be given only two more opportunities. The third failure disqualifies him. The examination papers are kept on file by the local car foreman. The questions usually comprise such items as inspector's duties, grouping of car parts so as to classify inspection accordingly, the functions of various car parts so as to establish the reasons for intensive inspection, questions as to loading rules and their requirements, safety appliances, air brakes, A. R. A. interchange rules, etc.

Air brake inspection

There are so many parts of equipment which require inspection and proper care to attain efficient service that it is not possible to concentrate too much on one particular item of inspection without neglecting the others, yet the inspection of air brake apparatus is one of the most important, not only as a matter of safety, but to reduce

Chicago, Milwaukee & St. Paul Ry. Co.
Air Brake Bulletin
March 15, 1924

Under this heading is published air brake news of interest, rulings and other matters. You are invited to raise any question on these bulletins, addressing them to James Elder, General Air-Brake Supervisor, Milwaukee, Wis.

Since the bulletins on "Piston Travel" and "Leverage" were issued, I have received a number of questions pertaining to brake beam hangers, such as, what effect does a vertical brake beam hanger have on the brake? What causes one wheel on a truck to slide? What is the correct angle for the brake beam hangers? etc. Instead of answering these questions through the medium of the "Question Box" I will endeavor to answer them in this Educational Bulletin.

When a train is in motion, the force applied to the brake shoe to bring each car to a stop is applied to the lower-most points of the truck, while the forces that are urging the truck forward are, first: the force due to motion applied at the center of gravity of the truck, and second: the force due to motion of the car body, which is applied to the truck at the center plate, far above the center of gravity. The rail pull holding the truck back while the car body surges ahead. This condition inevitably results in a tilting of the truck, with a reduction of the normal weight on the rear pair of wheels and a corresponding increase of weight on the forward pair of wheels of each truck. It will be quite clear that when the forces referred to are brought into existence by any application of the brake, the rear wheels of the rear truck will carry less weight than any other pair of wheels under the car.

A typical example of the bulletins issued periodically covering various subjects

losses incurred in dragging brakes, leaking air, etc. Much attention is given to this feature of the work because it requires mechanical precision and perfection. It is essential that definite maintenance regulations be established for work done on the repair tracks and shops and if this has been well established and systematized it is then a question of constant and proper inspection for service on the road. The training of inspectors for this class of work must be specific and in detail, note for example the air brake bulletin issued for March 15. Inspectors are directed to observe hand brakes, air and signal hose, piping, brake rigging clearances, couplings, piston travel and the necessity of cleaning brake cylinders and slack adjusters, dirt collectors, triple valves, retainers, etc., at proper intervals.

The period of service is closely checked to determine

the renewal requirements. Brake cylinders and reservoirs are inspected to see that they are kept tightly secured to the supports. The instructions as to adjusting brakes, piston travel, brake levers and other items of detail are set up specifically and fully systematized. When brake shoes are found to have a reddish color inspectors know that this indicates long application of brakes which usually heats the wheels and, therefore, requires a close wheel inspection as well, and an examination of the brake apparatus must be made in order to determine the cause of heating.

As to the inspection for cleaning air brakes, the A.R.A. rules are followed closely. Reports of cleaning are sent to a central office and when it is found that the same cleaning is necessary to be repeated within three months of the last date special investigation is made tracing back to the original point to determine the methods employed or the responsibility for lax work. A form (No. 665) showing the records kept by the general air brake supervisor on which is tabulated the work done at various points on the system, is illustrated on this page.

Wheel inspection

The inspection of wheels can be reduced to a specific and systematic arrangement and this plan is of great convenience. The organization of forces for intensive inspection of wheels should be specifically set up by localities.

We have found that practice desirable and efficient in the manner of placing responsibility not only for passing wheels in inspection which should have been removed, but preventing undue removal of wheels which should have continued in service. All wheels and axles removed are checked at specified points and on each axle is marked the symbol showing the nature of defects for which removal was made, giving the car initials, number, station and date. The system of symbols used is as shown below:

Symbol	Wheel defect
W 1	All right for service
W 2	Bracket cracked
W 3	Brake-burned
W 4	Burned from fire
W 5	Chill worn through
W 6	Flange broken
W 7	Flange chipped
W 8	Flange worn thin
W 9	Flange worn vertical
W 10	Hub burst
W 11	Hub worn
W 12	Large axle fit
W 13	Loose wheel
W 14	Plate cracked—front
W 15	Plate cracked—back
W 16	Rim broken
W 17	Rim chipped
W 18	Seamy
W 19	Shelled out
W 20	Shoulder worn
W 21	Slid flat
W 22	Tread cracked
W 23	Tread worn out
W 24	Wheel broken
W 25	Wheel condemned by remounting gage

Other reports are rendered to show wheels pressed off, mounted, gage readings, etc., with a complete record by wheel numbers. Axles are classified in somewhat the same manner as wheels to cover defects. [The final installment of this paper will appear in an early issue of the *Railway Mechanical Engineer*.—EDITOR.]

Form 665 Revised
Chicago, Milwaukee & St. Paul R.R.Co., Car Department
Repairing and cleaning air brake apparatus

_____ 192 _____

Mr. James Elder,
Gen. Air Brake Supvr.,
Milwaukee Shops.

Following is report of air brake work performed at _____ for the month of _____ 192__, in freight and coach yards, transfer, house and repair tracks:

	Passenger		Freight	
	Sys'm	For'n	Sys'm	For'n
1. Number of brake cylinders cleaned having last cleaning date less than 9 mo. frt., 6 mo. pass.				
2. Number of brake cylinders cleaned having last cleaning date from 9 to 12 mo. frt.				
3. Number of brake cylinders cleaned that had not been cleaned within 12 mo. frt. 6 mo. pass.				
4. Number of cylinder packings renewed				
5. Number of cars having brakes tested with air pressure while on repair tracks				
6. Number of air hose applied				
7. Number of angle cocks removed and exch.				
8. Number of retaining valves cleaned Number of retaining valves exchanged				
9. Number of freight cars repaired and delivered off repair track during month as shown on bad order report				
10. Number of slack adjusters cleaned				
11. Number of passenger triple valves changed				
12.				
Work performed in triple valve and air brake shops				
13. Number of triple valves passing final test over A.R.A. test rack				
14. Number of triple valves having repairs made to slide or graduating valves, piston ring or bushing				
15. Number of air hose mounted and tested under air pressure				
16. Number of angle cocks repaired				
17. Number of retaining valves repaired				
18.				

Whenever necessary to re-clean brake equipment, passenger or freight as per rule 60 due to being inoperative in less than 3 mo., car initial, number, last place and date of cleaning, also cause for brakes being inoperative to be shown below.

Record of incoming and outgoing air brake inspection of freight trains	Passenger Sys'm	Passenger For'n	Freight Sys'm	Freight For'n
19. Number of arriving trains on which incoming test was made				
20. Number of arriving trains having less than 85 per cent effective brakes				
21. Number of cars set out for repair tracks due to inoperative brakes (brakes sticking or old air dates not considered)				
22. Number of cars set out due to old air dates				
23. Number of defective air hose replaced				
24. Number of cars with improper piston travel which were corrected				
25. Number of cars set out for damaged wheels or burnt brake shoes due to defective air brakes				

Record of cars found necessary to re-clean before being 3 mo. in service

Date	: Number and Initials :	Kind of triple	Last place and date of cleaning	Remarks

Checked by _____ Foreman

Report of air brake equipment cleaned and repaired

THE MISSOURI PACIFIC has adopted a plan in its mechanical department whereby employees are invited to make suggestions to bring about greater efficiency and convenience in doing their work. Boxes are installed in the departments and blanks are provided for the employees. The suggestions are acted upon by two committees, one a production committee composed entirely of employees and an executive committee composed of three employees, the superintendent and the production engineer. The production committee first considers all suggestions, and, if they are considered worth adoption, passes them to the executive committee.

General view of the upholstering department at the North Billerica Shops of the Boston & Maine

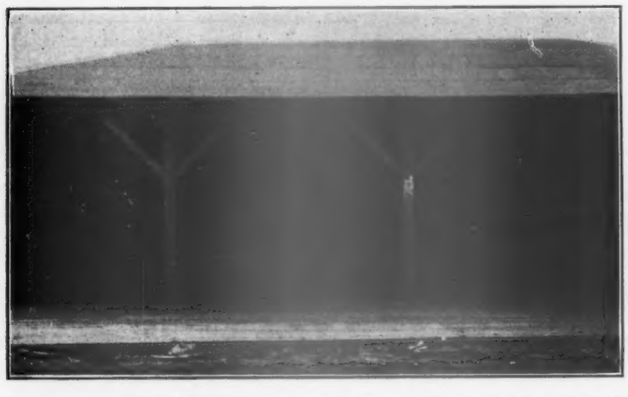
Renovating interior trimmings of passenger cars

Proper location of tools and equipment has made possible the repair of upholstering by the progressive system

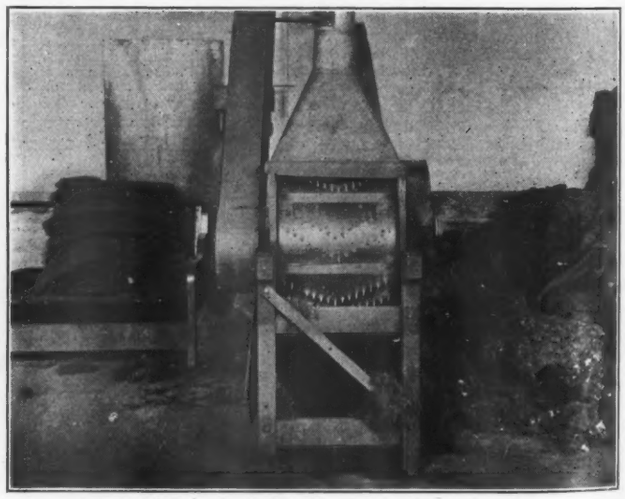
Part I

WHEN laying out the car department for the North Billerica shops of the Boston & Maine, considerable thought and careful planning was devoted to the upholstering and lacquering departments. These departments were planned and equipped to handle all of the interior trimmings of passenger cars on the system. The interior trimmings of from four to five cars are renovated in these departments every eight hour working day by a total working force of 25 men. In order to maintain this schedule, the work is routed through the departments, especially the upholstery shop, so that it will progress from one operation to the other in the same direction, thus eliminating any unnecessary handling of the work. The proper location of tools and equipment has made possible this system of progressive repairs.

The lacquering department has adopted the most modern methods available for cleaning and plating metal trimmings.



Shed where dust is blown from car seats and window blinds before they are taken to the cleaning room



Machine for shredding hair used in car seats

The acid, washing and plating tanks are located in such a manner so as to insure a minimum lost motion in handling the work from one process to the other. Considerable study has been given to the protection of the workmen against the poisonous fumes of the chemicals used. The fumes are

carried away by a suction draft system leading from each acid containing vat.

The upholstering department

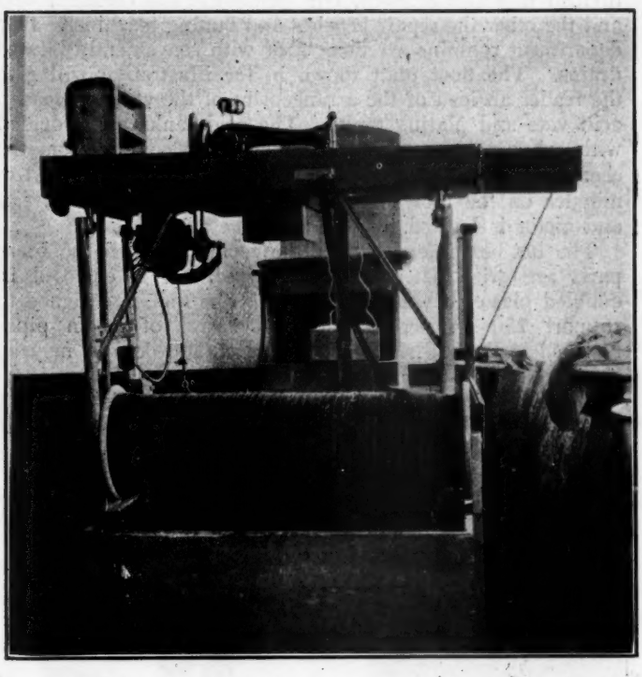
The upholstery and lacquer departments are located on the second floor of the paint shop which is in the same building in which the passenger cars are repaired. All the work is brought up to these departments on a freight elevator

Pantasote seats and window blinds drying after receiving final coat of Imperial renovator

which is convenient to the shed where the dust is blown from the window blinds, seats and backs.

Located at the rear of the upholstery shop are the cleaning, drying and hair picking rooms. At the front of the shop are the repair benches, sewing machines and upholstery storage space. With this arrangement, the car seats and window blinds enter the cleaning room and pass in one direction through the various processes of renovation until they are complete, when they are either taken direct to the car for which they are intended or are placed in storage until needed.

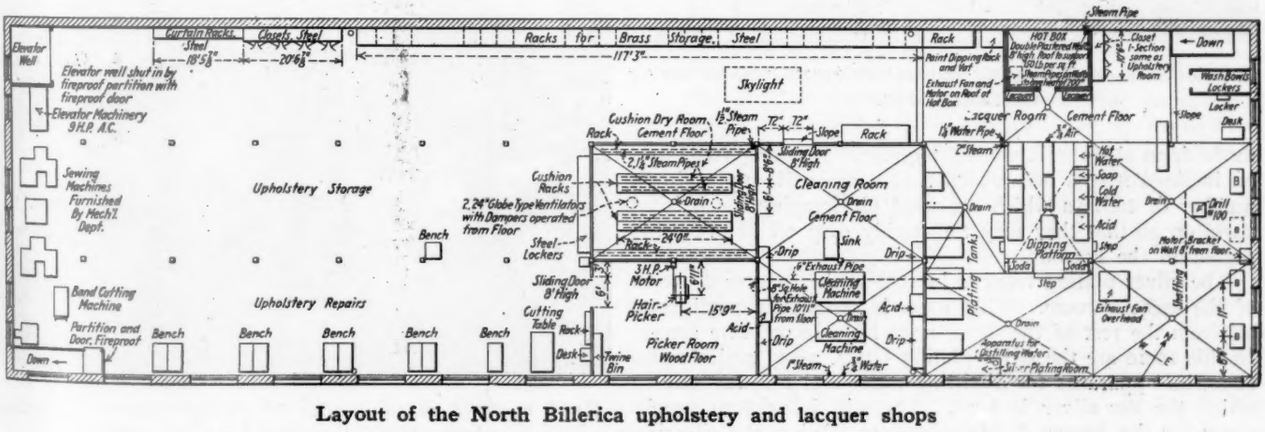
The cleaning room is a large, well lighted room containing a cement floor properly sloped so that the water will run into two drains. On each side of the room, next to the wall and close to the windows is a sink with two sloping drip boards. These are used for washing and dyeing the plush seats. Another sink is located approximately in the center of the room which is used for washing by hand the window blinds and Pantasote seats. Cleaning machines are located between the two sinks for cleansing the plush seats. The two principal parts of these machines are the table and the swinging, revolving brush. The table is mounted on a movable carriage which can be moved back and forth, parallel to the center line of the brush spindle. The table has a motion transverse to the movement of the carriage. It has a vertical adjustment to take care of the various sizes of seats and the wear of the fiber brush, which is motor



Two-needle sewing machine with a special attachment for inserting two strands of No. 60 twine in binding for car seats and backs

driven and can be swung back and forth over the work on the table.

The drying room for the cushions is entered directly from the cleaning room. It contains six racks which have sufficient capacity to hold the seats and backs of five cars. Each rack has two 1¼-in. steam pipes passing through it. In the floor between the two main racks are located two 24-in. globe type ventilators with dampers. When in operation, this room is shut off from the cleaning room by a 6-ft. by 8-ft. sliding insulated steel door.



Layout of the North Billerica upholstery and lacquer shops

Next to the drying room is the hair picking room which is entered from the upholstering department. In this room is located a hair picking machine which separates the hair after it has been washed. The machine consists of a belt driven drum containing shredding teeth. The dust and fine

hair is carried off through a hood located over the drum.

The lacquer room

The lacquer or brass renovating room is practically divided into two sections, one containing the chemical vats and the other the repair benches and buffing machines. This department contains a cement floor with conveniently located drains. The floor plan shown in the illustration will give the reader an idea of the arrangement of the various wooden acid vats and plating tanks. The acid tanks are provided with exhaust pipes to carry off the gases coming from the chemicals used. The piping for this exhaust system terminates on the roof of the hot-box where the exhaust fan and motor is located.

The hot-box referred to is the room in which the brass parts are dried after being lacquered. It is enclosed in doubled plastered walls 8 ft. high. The roof is designed to support 150 lb. per sq. in. By means of steam pipes fastened to the walls, a temperature of 200 deg. F. may be obtained.

Located next to the west wall of the hot-box is the paint vat, in which car gates, locomotive headlight casings, car hand brake levers, etc., are dipped. The vat and its lid are

Interior view of the drying room showing method of drying car seats and backs

made from sheet steel riveted together. Running from it is an inclined trough over which runs a monorail supporting a number of trolleys which are used for hanging the painted parts on so that they may thoroughly drip off before being placed in the hot-box.

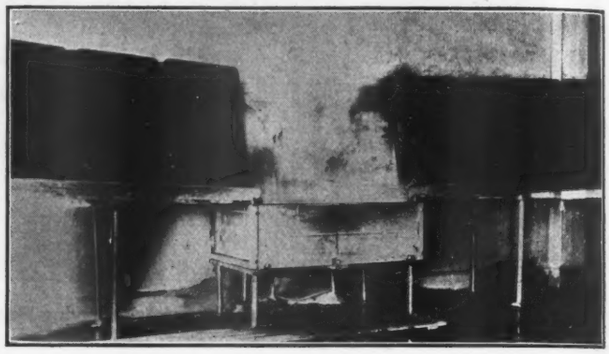
The silver plating room is located at the southwest corner of the lacquer room. This room is completely partitioned off from the rest of the department by a heavy wire screen. In this room are the silver plating tanks, assay scales under glass, an apparatus for distilling water and a heavy safe in which the bar silver is kept. The still is used to supply water for the Boston & Maine system. When the silvering tanks are not in use, they are covered over to keep foreign matter from the silvering solution.

Renovating car cushions and window blinds

Before the passenger cars are placed on the repair tracks in the shop, the interior trimmings are removed. The metal fixtures and trimmings are taken direct to the lacquer room while the window blinds and the seats and backs are hauled on four wheel trucks to the blowing-off shed located at the southwest end of the paint shop. This shed, shown in the illustration, is entirely closed on two sides and partially on the side next to the paint shop. It contains two racks made from pipe, on which the cushions are placed while the dust is being removed. At a convenient distance from these racks are two air pipe outlets to which are attached suitable air hose for cleaning purposes. With this arrangement, the loose dust and dirt is thoroughly blown from the cushions and window blinds.

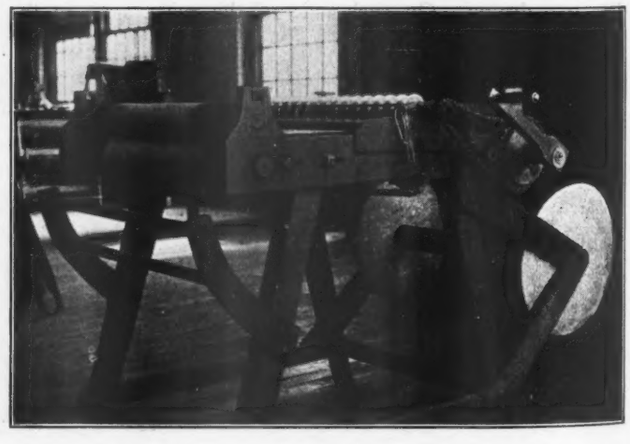
Cleaning the cushions and blinds

The cushions and blinds are then taken to the cleaning room. Here they are cleaned by the French Renovating



Plush seats draining off after being dipped in the dye solution

Company's plush renewing process. Forty gallons of warm water is run into the cleaning sink to which is added one bottle of French cleaner. This amount will clean the seats and backs for one car, or a total of 76 pieces. They are thoroughly soaked in the cleaning solution and then placed on the sloping drip boards to drain off. They are then placed on the cleaning table shown in the illustration where they are thoroughly cleaned by the fibre brush which revolves at a speed of 1,700 r.p.m. This removes all dirt, soot and grease, so that the dye, which is next applied, may penetrate the fibre of the fabric. If the dirt were not thoroughly



Hand operated machine with 15 circular knives for cutting plush cloth into strips for seat binding

removed, before the application of the dye, both the dirt and the dye would be removed on the clothing of passengers after the cars were again placed in service. This process also thoroughly disinfects the cushions.

The dye solution is prepared in a vat directly across from the cleaning sink. The cushions are again dipped and allowed to drain off, after which they are placed in the drying room. They remain in this room over night and then are taken to the repair benches.

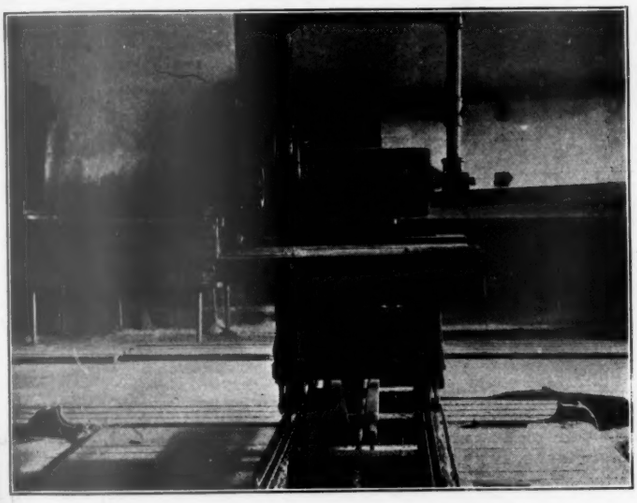
Pantosote seats and window blinds are scrubbed by hand with soap and water. They are then placed in the drying room, after which the Imperial renovator is applied by hand which leaves a dull finish. After the blinds are painted, they are hung on a specially designed rack to dry as shown in the illustration. The Pantosote seats are placed to dry in rows on the floor.

The cushions and blinds are cleaned on a piece work basis. One man can clean in a day the cushions from three cars while two men can clean those from five to six cars.

How repairs are made

After the seats and curtains are cleaned, they are given minor repairs or completely rebuilt. Such defects as worn or torn plush, burlap covering over the springs giving away, broken or worn out springs or a broken wooden frame keep the repairmen busy. When a seat is completely overhauled the hair contained in it is passed through the hair picking machine shown in the illustration, which tears it apart and restores its fluffy condition.

An interesting operation in connection with repairing the seats, is the method of making the plush binding which goes around the edge of the seats. Plush cloth 28 in. wide is



Machine for cleaning plush seats and backs after they have been dipped in the cleaning solution

passed through a hand operated machine containing 15 evenly spaced circular knife blades which cut the plush into strips 1⅞ in. wide. The machine shown in the illustration is mounted on a wooden frame which has at each end a set of wooden rollers, covered with sand paper, for the purpose of pulling the cloth through the machine. The trunnions of the upper roll run in rectangular slots. On the trunnions are wooden caps upon which are placed a spring which allows the top roll to be opened in order to start the plush through the machine. These springs also serve the purpose of compressing the top roll on the plush so that the abrasive paper will grip the cloth. The arbor holding the cutting blades is turned by means of a hand operated sprocket wheel and chain. The blades may be readily removed for sharpening.

The ends of the strips are sewed together and are then ready for the following operation. The plush band is sewed in a two needle motor driven sewing machine placed on a suitable table which is mounted on a raised platform on which the operator sits. The plush strip is contained in a box underneath the platform and is fed up to the machine. The illustration of this machine shows two balls of No. 60 twine leading up to the needles of the machine. This is fed through a special attachment which forms the double beading of the plush band. The band measures ⅞ in. wide when finished. These two machines, along with additional sewing machines and cutting tables, are located at the west end of the shop. On these machines the window blinds are repaired or new blinds made to replace the old ones. In this shop are made all the blinds for the Boston & Maine system.

The operations in the lacquering department will be described in the concluding part of this article, in the January issue.

Decisions of the Arbitration Committee

(*The Arbitration Committee of the A.R.A. Mechanical Division is called upon to render decisions on a large number of questions and controversies which are submitted from time to time. As these matters are of interest not only to railroad officers but also to car inspectors and others, the Railway Mechanical Engineer will print abstracts of decisions as rendered.*)

Repairs occasioned by one shopping not consolidated in same bill

Maine Central car No. 3763 was shopped by the Boston & Maine at the East Fitchburg, Mass., shops on December 12, 1922; a wheel change having been made and also two journal bearings applied on that date, charges for which were included in the January, 1923, bill, supported by the proper billing repair cards. Other repairs were made and charges included in the February, 1923, bill, also supported by the proper billing repair cards.

The Maine Central claimed that the Boston & Maine should have withheld the bill for the wheel change until such time as the bill for the balance of the repairs to the car were completed and the two bills consolidated to reach that company as a complete charge for repairs to the car in accordance with Rule 93. The Boston & Maine claimed that Rule 93 did not cover the case in question, its interpretation of the rule being that one single bill must be made each month, but that the rule does not require all of the repairs made to a car to be included in the same bill. The contention was that, inasmuch as the repairs were continuous and the car was not released for service until all repairs were completed, the fact that part of the expense of repairs were included in the month of January and the balance of the repairs in February, in no way released the Maine Central from its obligation to pay the bill presented in the February, 1923, account.

The Arbitration Committee in rendering a decision in this case, stated that: "It is important that all proper charges for repairs occasioned by the same shopping of the car be consolidated in the monthly bill to enable proper check of all charges, overlapping labor items, etc. The circumstances in this case, however, do not justify cancellation of the subsequent charge. This decision has no bearing on previous decisions with reference to charges omitted, reopening accounts, etc."—*Case No.* 1314, *Maine Central vs. Boston & Maine.*

Charges rendered on authority of defect card

The Southern Pacific removed one pair of cast iron wheels from El Paso & South Western car No. 20369 on account of one wheel being loose on the axle, and applied one pair of new rolled steel wheels which were standard to the car. A bill was rendered against the car owners on authority of copy of defect card issued by the Chicago, Rock Island & Pacific and billing repair card, the charges for wheel centers and service metal of the steel wheels being based upon A. R. A. Rules 98 and 101, effective February 21, 1922, the date of the defect card, instead of the rules as changed by Supplement No. 1 to

the 1921 Rules, effective May 1, 1922. The Chicago, Rock Island & Pacific had removed a pair of steel wheels from this car and applied a pair of cast iron wheels. Credit was allowed the car owner for the difference in value of the wheels applied and those removed and defect card was issued as required by the rules. The car owner contended that the defect card authorized A. R. A. prices at the time the defect card was issued only for such items as the defect card authorized the car owner to bill the company that made the improper repairs. It further contended that the repairs were not made by the Southern Pacific on account of improper repairs, but on account of the car owner's defect in accordance with Rule 81, and that the billing repair card and Rule 98, not the defect card, authorized the charge against the car owners for wheel centers and service metal. The steel wheels applied should have been furnished at current A.R.A. prices as under Rule 98, the defect card being only for the protection of the car owner. The Southern Pacific maintained that the defect card was its only authority for a charge against the car owner under Rule 98 and that if, therefore, the defect card actually performed such function, it was entitled to charge prices in effect at the date of the card or at the same rates as credit allowed by the Chicago, Rock Island & Pacific when making the wrong repairs. The Southern Pacific further stated that the principle that the date of the defect card governs has been so long established, that railroads have not questioned it in recent years.

The Arbitration Committee rendered a decision sustaining the contention of the Southern Pacific and referred to the decision rendered in connection with case No. 1273.—*Case No.* 1316, *El Paso & South Western vs. Southern Pacific.*

Car and engine replacer clamp

FREQUENTLY a car and engine replacer will not stay in position when the wheel is being moved up and onto the rail. The clamp shown in Fig. 1 has been designed to overcome this difficulty. Holes for the clamp

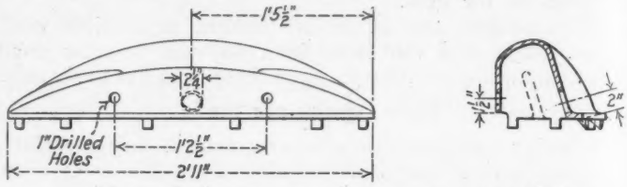


Fig. 2—Drawing showing the location of the holes in the replacer for the clamp

are drilled in the replacer as shown in Fig. 2. The clamp is made in two lengths as shown in Fig. 1, the shorter of which is used for holding the replacer against a standard rail. The method of holding the replacer to the rail with the clamp is shown in the drawing in the lower right hand corner of Fig. 1. The extension clamp is designed to be used for derailments at frogs and switches where it is impossible to fasten the hook of the shorter clamp on the flange of the outside rail. The extension is provided with a number of notches on which the extension clamp slide can be adjusted. The replacer is held securely to the rail by the replace clamp wedge which is inserted in the 3⅜-in. by 7/16-in. slot in the clamp. The replacer equipment is carried on the side of the tender.

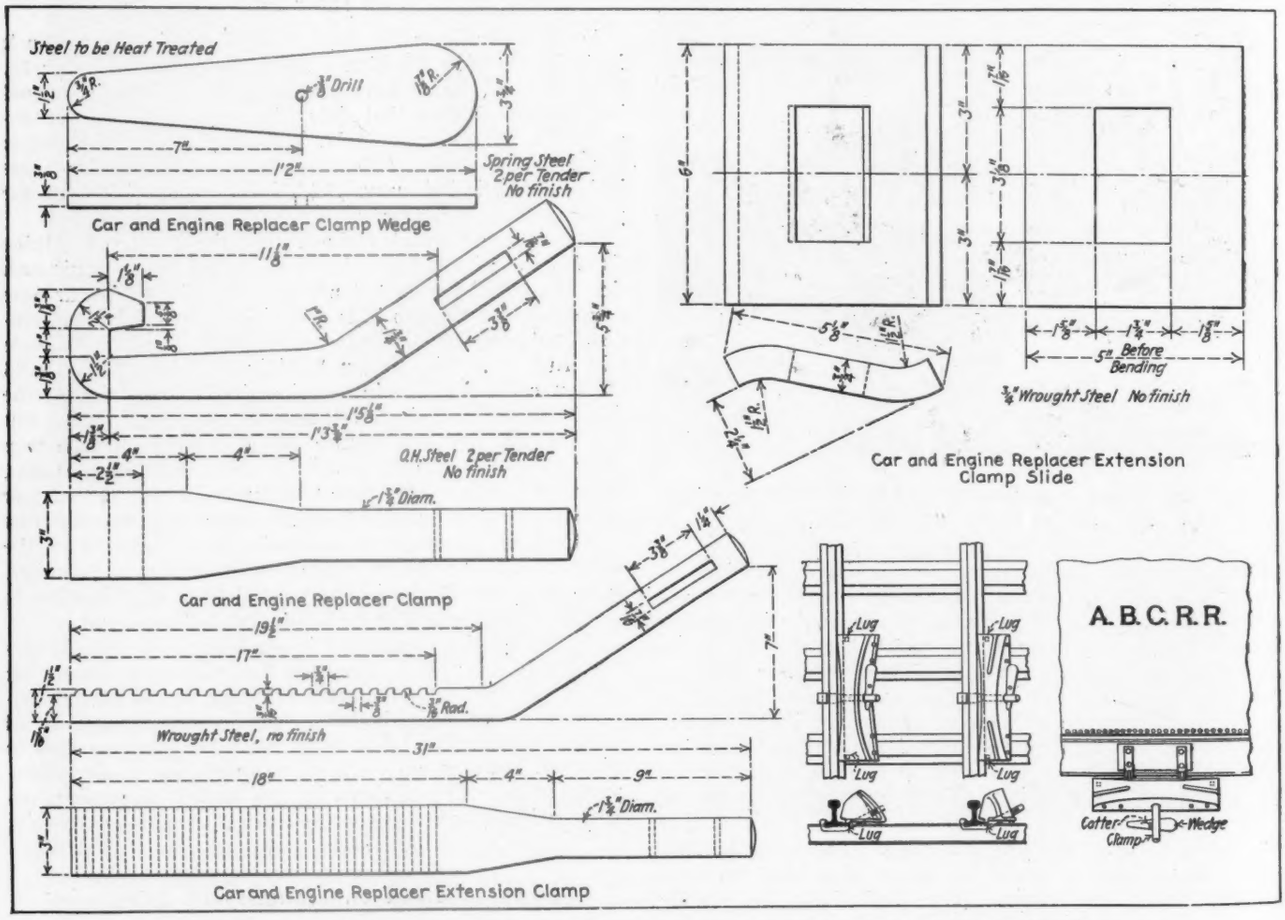
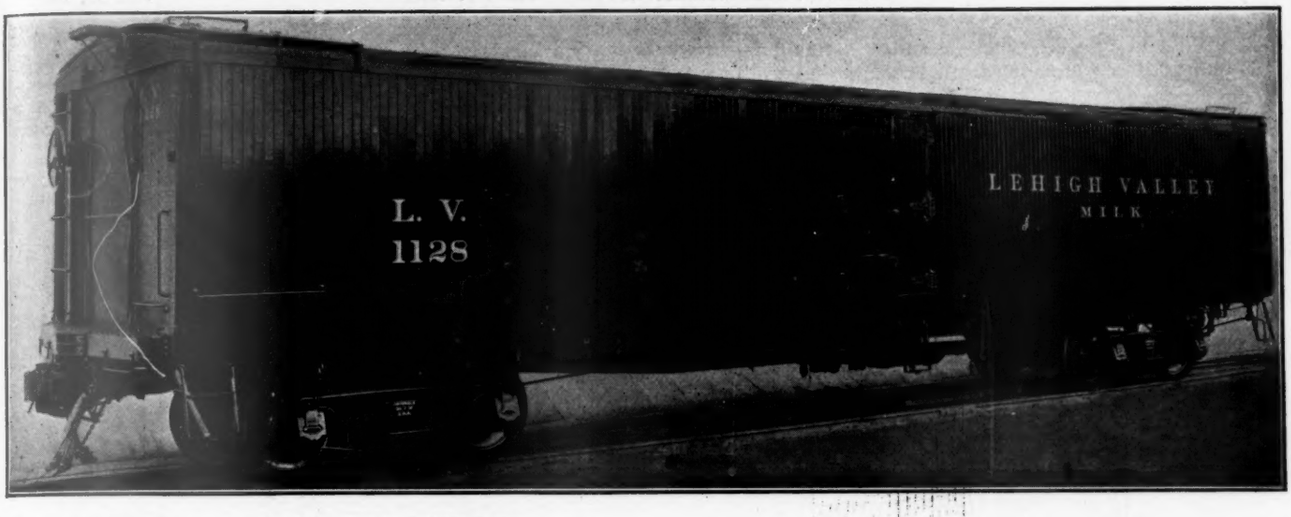


Fig. 1—Drawing of the details of the replacer clamp and the application to the rail



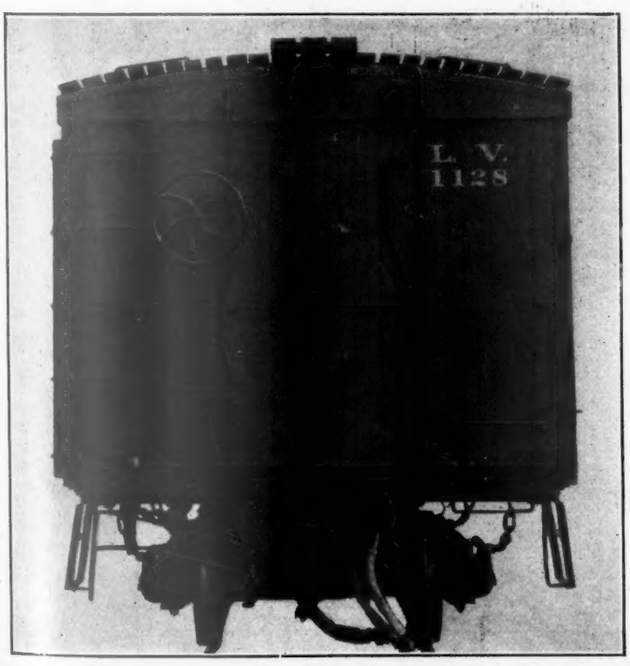
Large capacity milk cars recently built for the Lehigh Valley

New type milk cars for the Lehigh Valley

Departure from conventional design has effected increase in loading capacity—Unique truck construction

THE Lehigh Valley has recently placed in service 25 milk cars, the design of which differs materially from previous equipment used in that class of traffic. These cars were built at the Berwick plant of the American Car & Foundry Company in the early part of 1924.

The change in design has particularly affected the arrangement of the ice bunkers. In previous milk cars the bunkers, four in number, were located at each side of the end door vestibules and extended from floor to roof. In the new cars the end doors have been eliminated and an ice bunker built across each end of the car. The bottom of the bunkers is at a height of 27½ in. from the floor which permits the loading of milk cans underneath. The car body as a whole has been designed with the idea of providing maximum loading capacity and, aside from the change in ice bunker arrangement, the inside width has been increased 6 in. so that eight milk cans may be placed in a row across the car. The side doors have been arranged to swing outward instead of into the car which allows for additional loading space. These changes have served to increase the individual car capacity to a total of 370 40-quart cans which represents an increase of 40 cans over the capacity of previous cars. The ice capacity has been increased from 5,880 lb. to 9,000 lb.



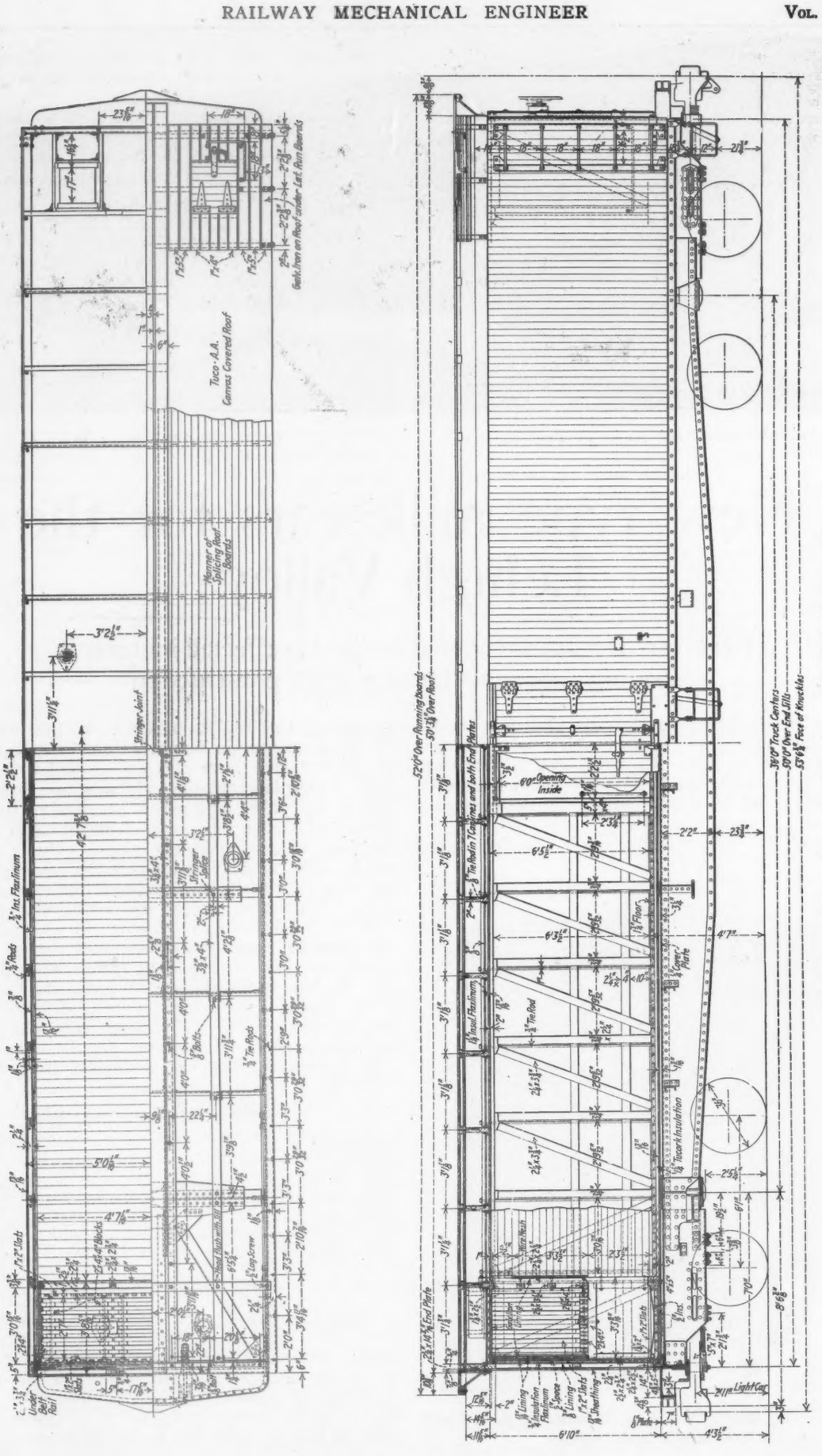
End view of car showing location of retainer, train signal and conductor's brake valves

Principal dimensions and weights

Length over body end sills	50 ft. 0 in.
Length inside	49 ft. 4⅛ in.
Length between bunkers	42 ft. 7⅜ in.
Width inside	9 ft. 2⅛ in.
Width at eaves	10 ft. 1⅜ in.
Total capacity of ice bunkers	9,000 lb.
Distance from center to center of trucks	36 ft. 0 in.
Truck wheel base	6 ft. 1 in.
Net capacity of car, including ice	85,500 lb.
Light weight of car complete	68,400 lb.
Loaded weight of car	153,900 lb.

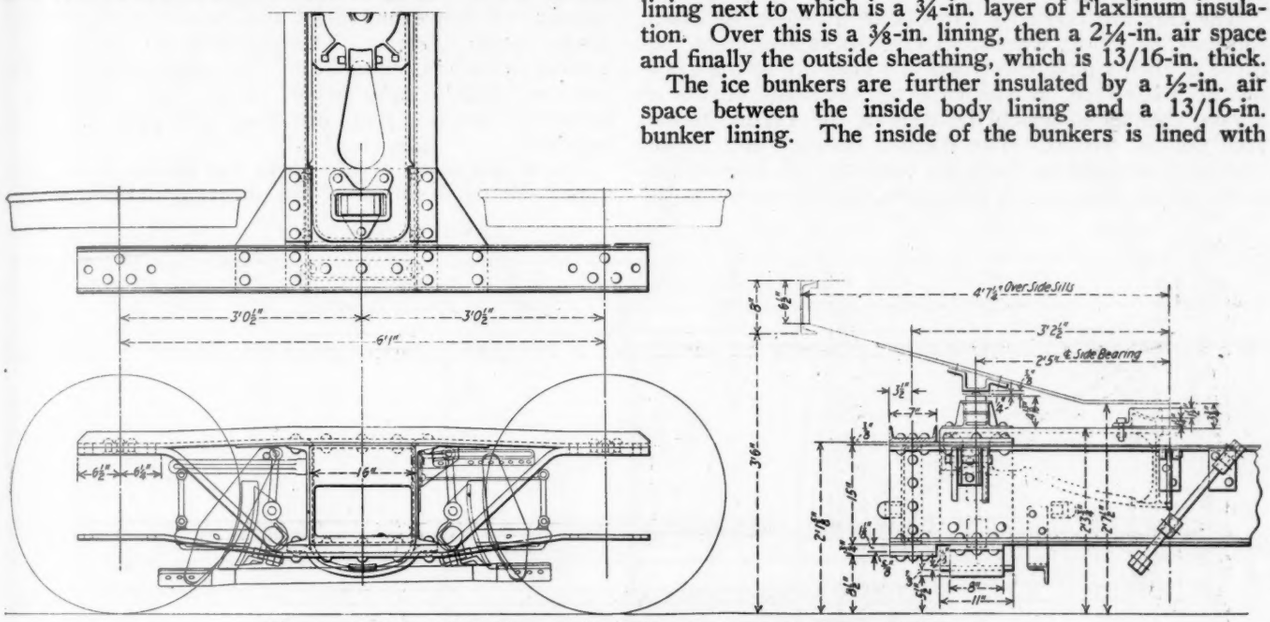
Underframe construction

These cars have a steel underframe and wooden superstructure. The underframe is of the fish-belly type with double center sills, the depth of these sills at the middle of the car being 26 in. The center sills are of plate and angle girder construction with 5/16-in. web plates reinforced by 3½-in. by 3½-in. by ⅜-in. angles on the outsides of the top chord and by the same size angles on the



Side sectional elevation and plan view of Lehigh Valley milk car

inside and outside of the bottom chords. A 21¼-in. by ¼-in. top cover plate extending the full length of the underframe serves further to reinforce the center sills. The side sills consist of two 8-in., 11.5-lb. channels, to each of which is riveted a 3-in. by 3½-in. by ⅜-in. angle for supporting the wood side sills. The cars are equipped with built up extended end sills as shown in one of the illustrations. The body bolsters, cross-bearers and diaphragms are of conventional design. The underframe construction follows closely that adopted as U.S.R.A. standard design for refrigerator cars.



The truck frame is built up principally of standard structural shapes

Car body and trucks

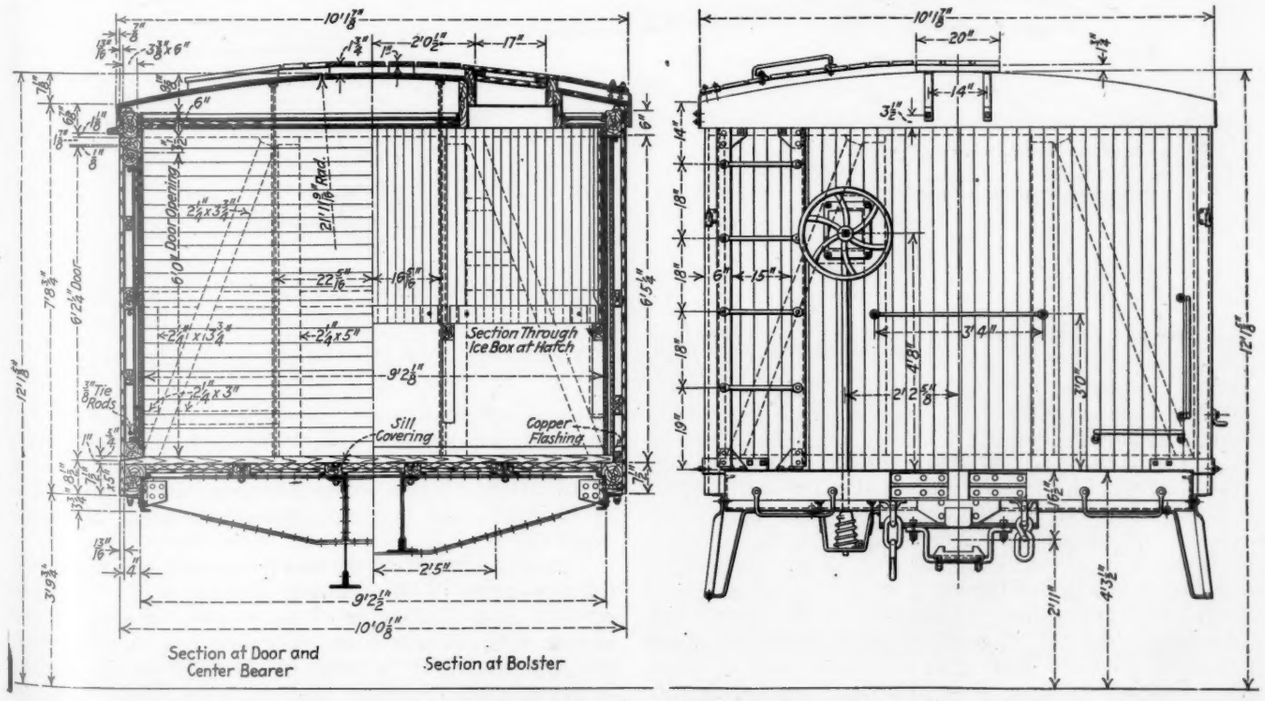
The design of the super-structure provides excellent ventilation. The construction of the body framing follows the usual practice with 2¼-in. by 3¾-in. side posts and diagonal braces. Vertical, transverse and longitudinal tie rods are provided.

The floor construction consists of a 13/16-in. false floor laid over floor stringers, then a 1¼-in. layer of Tucork insulation over which is laid 1¾-in. tongue and grooved flooring. The sides of the car have a 13/16-in. inside lining next to which is a ¾-in. layer of Flaxlinum insulation. Over this is a ⅜-in. lining, then a 2¼-in. air space and finally the outside sheathing, which is 13/16-in. thick.

The ice bunkers are further insulated by a ½-in. air space between the inside body lining and a 13/16-in. bunker lining. The inside of the bunkers is lined with galvanized iron over which is secured 1-in. by 2-in. slats. Two icing hatches, with 17-in. openings, have been provided for each bunker.

The end doors have been eliminated in this design and double side doors, swinging outward, provide an inside opening of 4 ft. 5 in. by 6 ft. A Miner door locking device is used on these doors.

The ceiling, which consists of ⅜-in. and 13/16-in.



End elevation and cross sections

wood courses with a 1¼-in. layer of Flaxlinum between, is beneath the carlines. The roof sheathing is covered with Tuco A-A canvas. The roof on these cars has been considerably flattened as compared with the conventional oval type roof ordinarily found on milk cars. Running boards of the box car type have been provided the full length of the car.

The cars are carried on trucks with 5½-in. by 10-in. journals and 36-in. wheels. These trucks are unique because of their simple construction. They are of the modified arch bar type, in which the top arch bar consists of a 7-in. channel to which the ends of the 1⅛-in. bottom arch bar is riveted. The column castings and spring plank are replaced by transoms consisting of 15-in. channels, spaced 16 in. apart, which are rigidly secured to the arch bars and reinforced by pressed steel end plates, through which are cut the window openings to accommodate the ends of the full elliptic springs. These springs rest in malleable iron seats supported by yokes of ⅝-in. by 11-in. steel plate, which are flanged over and riveted to the tops of the transom channels. These plates, which also form wearing strips for the ends of the bolster, are reinforced below the spring seats by ⅞-in. by 8-in. plates riveted to the bottom channel flanges.

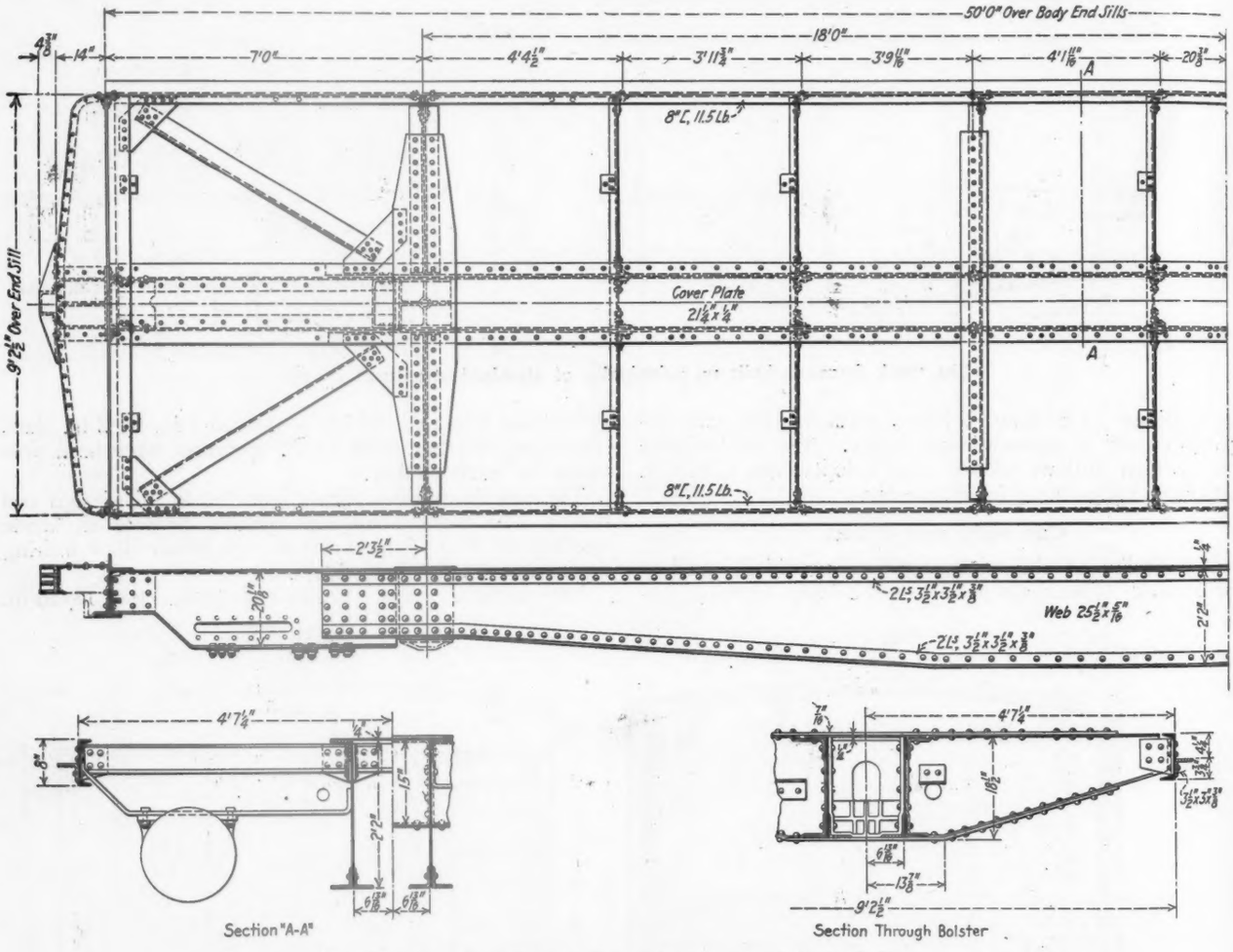
Westinghouse UC brake equipment and train signal equipment, Bradford draft gear and solid shank couplers with a Chaffee centering device comprise part of the car equipment.

Hooks, cables and chains for wrecking service

IT is the usual practice to include in wrecking equipment various kinds of hooks and arrangements of chains and cables in order to save time and labor when clearing up wrecks. A few examples of this type of equipment are shown in the drawing. These devices are not only convenient to have in the tool car of the wreck train, but they are also handy to have as part of the crane equipment in locomotive erecting shops and shops where car repairs are handled.

The arrangement of two hooks and chains shown in the upper left hand corner of the drawing is designed primarily for lifting trucks and various kinds of equipment on which it is better to take an inside hold. The chain is ¾-in., hand forged and is designed to carry a safe load of 10,000 lb. These chains are proof tested with a load of 11,160 lb. and have an approximate breaking load of 33,800 lb.

The arrangement of the two hooks and cables shown in the top center of the drawing is made of 1¼-in. bright monitor plow steel cable of six strands, 37 wires to the strand, with a hemp core. The end link and hooks are designed for the same factor of safety as the cable. This device is convenient for such work as lifting cabs and similar parts which are light but bulky to handle. The



Details of construction of the underframe and body bolsters

working load of each cable used straight is 16,500 lb.

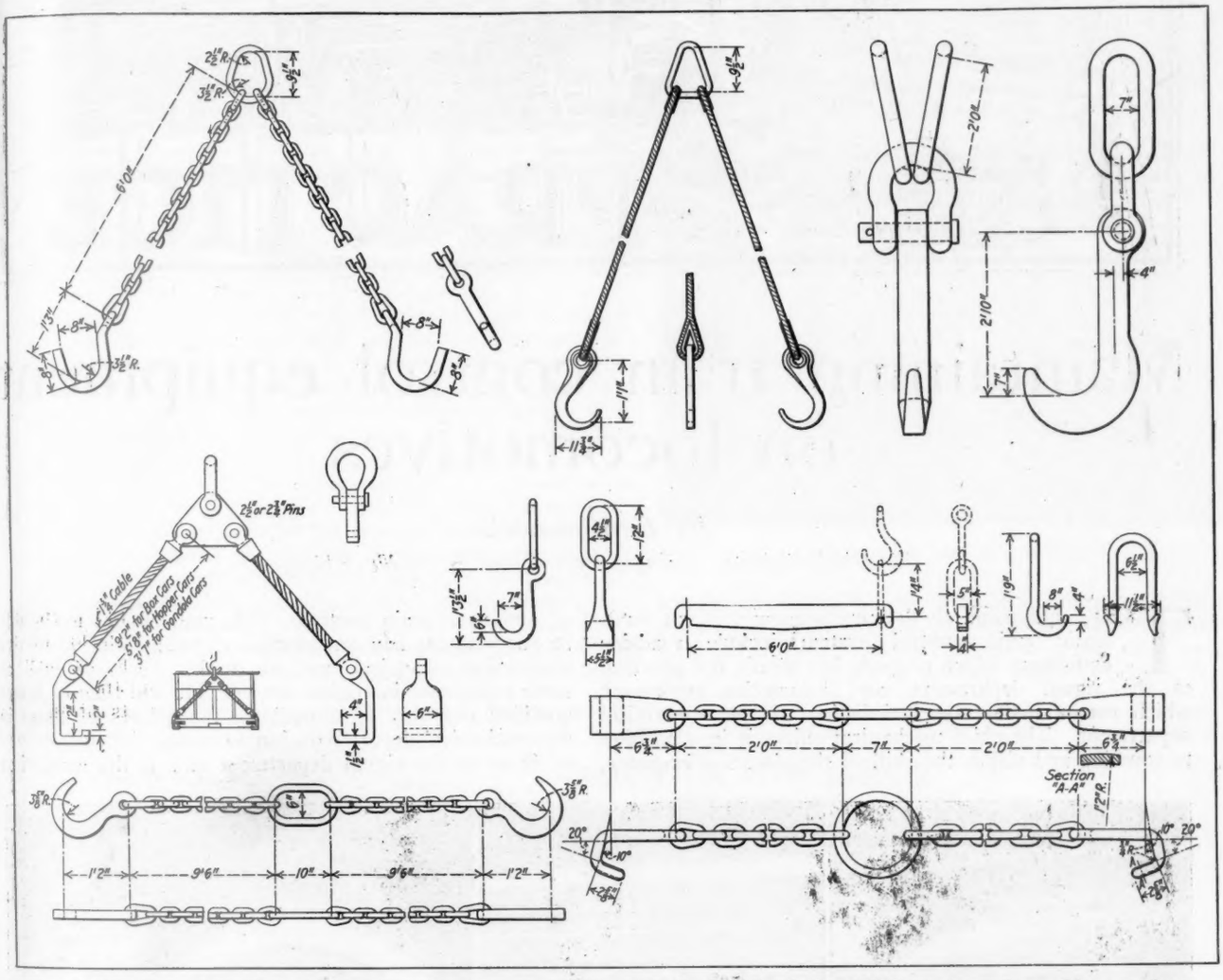
The crane hook shown in the upper right hand corner of the drawing is a fire box door hook. It is designed for heavy lifting, the hook, chains, pin and links having a working load of 100 tons with a factor of safety of five. The design of the hook gives it an exceptionally wide grip and at the same time permits it to hold a chain or cable without danger of slipping off.

The cable and hook arrangement shown at the left center of the drawing is designed especially for handling car bodies. It cannot be used for cars having concealed end sills. The method of application is shown in the small drawing. The design of the hook may be varied to suit the different classes of cars which have to be lifted with a crane.

The arrangement of chains, link and hooks shown in the lower left hand corner of the drawing is intended for general wrecking and crane service. It is designed for a safe load of 16,000 lb. and is proof tested with a load of 20,460 lb. The approximate breaking load is 62,000 lb.

The chains, link and hook shown in the lower right hand corner are made of ¾-in. hand forged iron and are designed for a safe load of 10,000 lb. They are proof tested for 11,160 lb. and have an approximate breaking load of 33,800 lb. The enlarged link and hooks should have as high a factor of safety on the chain.

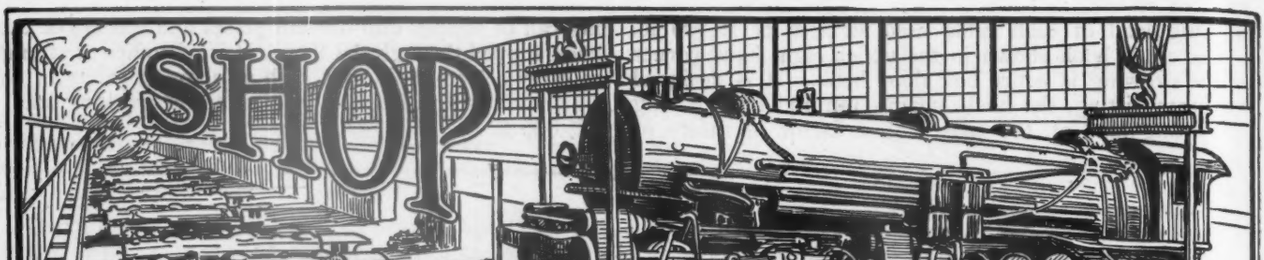
The double hook shown at the right center of the drawing can be slipped into difficult places and a chain or cable hook slipped through the loop. It is of sufficient strength to carry a load of 25 tons with a factor of safety of five. This hook is proof tested with an actual working load of 125,000 lb.



Details of a number of hook, chain and cable arrangements which have proved useful in crane and wrecking service

The hoisting hook and link shown at the left of the lifting beam is also designed for a working load of 25 tons with a factor of safety of five.

Interior of dining car used on the Siamese State Railways

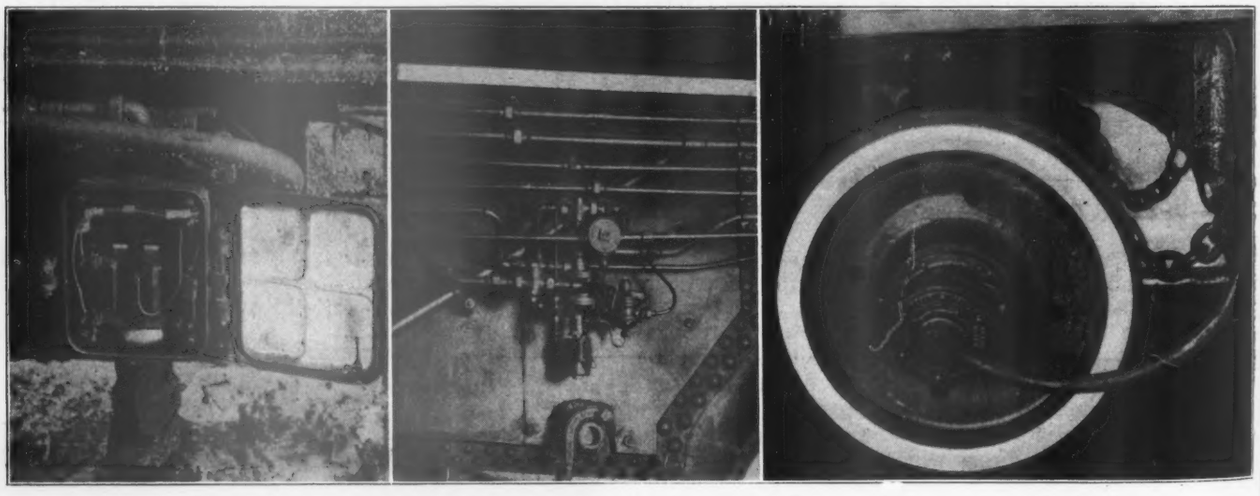


Maintaining train control equipment on locomotives

By E. Wanamaker

Electrical engineer, Chicago, Rock Island & Pacific, Chicago

THE equipment or devices necessary to an automatic train control system include roadside equipment which properly lies within the province of the signal department, and locomotive equipment which comes under the jurisdiction of the mechanical department. The chief mechanical officer is in a position to combine and utilize the skill of the electrical engineer, the mechanical engineer, the air brake engineer, and all others familiar with locomotive operation and maintenance. Familiarity with the many peculiarities of locomotive equipment and devices is a prime requisite.



Open shoe box, electro-pneumatic valve and speed controller—parts which must be maintained

Train control supervisor should be appointed

In order to co-ordinate successfully the efforts of all these in the mechanical department, it is highly advisable, if indeed not absolutely necessary, to appoint a supervisor of automatic train control. This man should preferably be one who has had considerable experience in locomotive mechanical, electrical, and air brake work, as well as some experience in engine service. He will then be better qualified not only to co-ordinate the efforts of those in the mechanical department, but to secure the co-operation of those in the signal department and at the same time enlist the necessary support of the division transportation officers. The successful operation of automatic train control depends quite largely on the skill and fidelity of the division officers functioning under the supervision of the automatic train control supervisor insofar as automatic train control is concerned.

The following paragraphs refer to automatic train control as applied to 165 miles of double track between Blue Island and Rock Island, Ill., on the Chicago, Rock

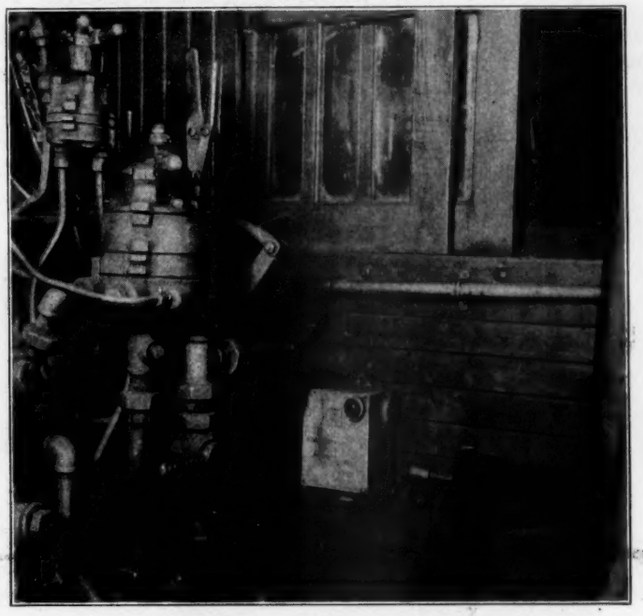
Island & Pacific. The system as now installed is of the intermittent electrical contact type, with 240 ramps installed and 103 locomotives equipped.

Automatic train control operation

Last February the operating rule requiring a train to stop at an automatic stop signal indicating stop, after which it may proceed through the stop block at a speed not to exceed eight miles an hour, was changed so that on all locomotives equipped with the automatic train control in operation the engineman may, upon reducing his speed to below 15 miles an hour, pass the stop signal without stopping and proceed, thus eliminating the stop at the stop signal.

As long as the signals are all clear there is no action of the automatic train control device. If approaching and passing a caution signal above a certain prescribed speed (in the case of a passenger train this speed is 30 miles an hour and for a freight train 25 miles an hour) an automatic brake application will result. This will reduce the speed of the train to within the prescribed limit, and upon arriving at that speed an indicator light is shown in the cab, which is the engineer's indication that he may release the brakes. Upon so doing he can proceed but only at the prescribed limit or speeds below. If he should not be alert for some reason or other and fails to operate the release, then the train will be stopped. Upon continuing through the caution block, if he should happen to exceed the caution limit, another application will result, necessitating a second operation of the release.

Upon approaching the stop signal, and if he should pass it above the prescribed speed, which is 15 miles an hour for both passenger and freight service, an automatic application of the brakes will result and the same release. If that button is not pushed while he is running below the prescribed speed of 15 miles an hour he will get an application, no matter at what speed he is running,

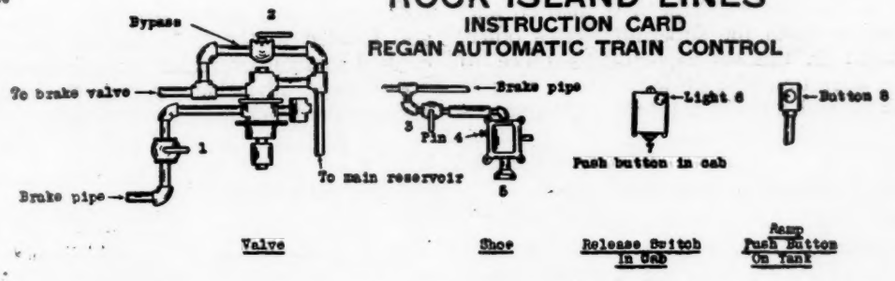


Cab indicator and release button

whether it be one, five or ten miles an hour. After he has passed the stop signal, if he should exceed the speed of 15 miles an hour or reach that speed at any time, he will get an application which will necessitate a release. If the

FORM M. P. 36

ROCK ISLAND LINES
INSTRUCTION CARD
REGAN AUTOMATIC TRAIN CONTROL



1. TO CUT DEVICE OUT OF SERVICE: Close cock 1 so that handle is in line with pipe and open cock 2 on bypass so that handle is crosswise with pipe. In case of heavy leak of air at shoe box also close cock 3 so that handle is in line with pipe.

2. TO PLACE DEVICE IN SERVICE: Open cocks 1 and 3 so that handle is crosswise with pipe and close cock 2 on bypass so that handle is in line with pipe.

3. DOUBLE HEADING: When double heading, on rear engine Raise shoe stem 5 to full height; pull out locking pin 4, give it one-quarter turn and see that it has entered the slot full length.

4. OPERATION:

(a) The train control apparatus does not interfere with the proper observance of rules governing air brake operation.

(b) CAUTION SIGNAL will enforce speed throughout the block not to exceed 30 miles per hour for passenger trains and 25 miles per hour for freight trains. To avoid unnecessary application of the brakes, speeds should be maintained below these limits.

(c) STOP SIGNAL: At a stop block, ramp push button number 8 on tank must be pushed in before shoe engages ramp, and held in so long as shoe is on ramp. If stopped with shoe on ramp, button 8 must be pushed in and held in until shoe is off ramp.

(d) A stop signal will enforce speed not to exceed 15 miles per hour throughout the block for both passenger and freight trains. To avoid unnecessary application of the brakes, a speed should be maintained below that limit.

(e) RELEASE SWITCH IN CAB: Whenever device makes brake pipe reduction, place brake valve in lap position until train is running below prescribed speed; then when indicator light 6 is displayed, push the button 7 which will extinguish the light, and proceed to follow prescribed rules of proper air brake operation as though you had made the application yourself.

(f) IN CASE OF IMPROPER OPERATION: Should the device improperly apply the brakes, it must not be cut out of service until the ramp next ahead has been passed. The only exception to this rule will be permitted when, with the train at stop, it is impossible to release the brakes after pushing button 7.

(g) Report any improper working of the device to the Train Dispatcher and on work report.

Card placed in the cab for the instruction of enginemen regarding train control operation

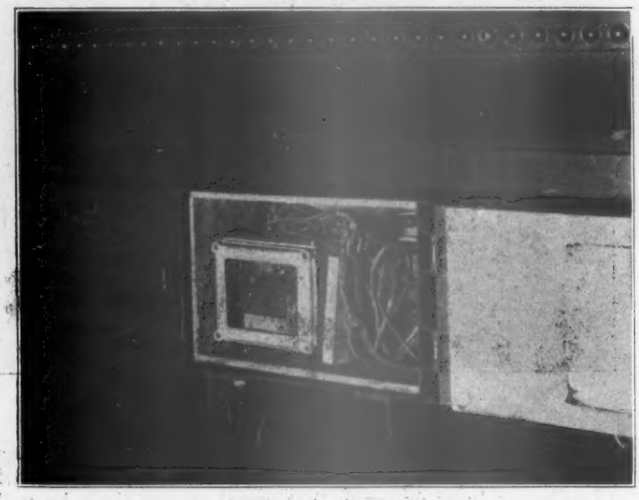
ing operation must be carried out as explained for the caution signal. However, if he should pass this stop signal below 15 miles an hour (having operated a secondary push button which is on the tank and inside the gangway) he can pass over the ramp without an application. next signal is clear, his high speed is restored and he can proceed at unlimited speed.

The roadside apparatus used is a ramp located at each signal, the energy supply to the ramp being from a roadside battery controlled by the signal circuits. The loco-

motive apparatus consists of the shoe mechanism located on the No. 1 tank truck; an indication selector or relay and storage battery; the speed controller on the No. 1 engine truck wheel; an electro-pneumatic reservoir and brake valve, with an exhaust control valve and suitable cocks arranged so as to cut the apparatus out in case it should be necessary; release switch; and tank button, all suitably connected by conduit and wire.

The electrical engineer has general supervision

The automatic train control is supervised by the electrical engineer who acts more or less as the directing and consulting engineer in connection therewith. The supervisor of automatic train control, reporting directly to the superintendent of motive power of the first district, also works in direct contact with the superintendent's office. A clerk is employed in the superintendent's office to follow in detail the operation of each locomotive, compile information and data, and quickly transmit to the supervisor of automatic train control any irregularity of operation that shows up, for his immediate attention. This clerk is one of the most important links in train control operation. He should be a man of considerable ability. He is charged with the responsibility of interpreting the reports from the various maintenance points and train dispatcher and following them up for corrective action when necessary.



Relay box—One reason why maintainers must understand electrical circuits

Automatic train control locomotive maintainers are located at the various locomotive terminals on the division, of which there are five maintenance points, two at Chicago, one at Peoria, Ill., and two at Rock Island, Ill., the western terminus of the division. In general the regular electrical maintenance men at enginehouses and back shops absorb most of the work so that comparatively few maintainers are needed and the working hours of these men are arranged to meet the requirements of the engines dispatched. In other words it is not always necessary to have a maintainer and helper on each shift at each of the maintenance points. The work of these men is arranged so as to utilize fully the available man power.

The maintainers report to the roundhouse foremen, who are responsible for the locomotives getting out on time and in satisfactory condition, both as to mechanical features and electrical features. Therefore, it is highly important, if not the most important duty of the supervisor of automatic train control, to see that good relations exist between the maintenance forces and the roundhouse authorities, and to act in accord with the roundhouse forces; to make of himself a good influence on the division, looked up to and respected by every operating officer concerned in both the transportation and mechanical departments as well as soliciting the unqualified support of the enginemen. The degree of success he makes in this direction is an important factor in the smoothness, quickness and intelligence with which the train control is maintained and operated. He must become well acquainted with the enginemen, firemen, trainmen and conductors; he must so conduct himself that these men will look to him for information and advice and depend upon him implicitly in train control matters.

The train control apparatus is maintained in a similar manner to any other locomotive appliance; that is, the engineman, upon arrival at a terminal fills out in a space provided on his engineman's work report, the condition of the automatic train control apparatus. If some repairs are necessary a work slip is made out from this work report the same as for any other part of the locomotive, and handed to the train control maintainer. The train control maintainer makes such inspection and repairs as are deemed advisable and reports back to the foreman, signing the work report accordingly. At the end of each day, another form called "The Automatic Train Control Inspection Report," is filled out, giving a record of all locomotives arriving at that particular terminal, the condition on arrival, and any remarks considered necessary to explain the condition of the train control equipment. This form also gives a record of all locomotives departing from the terminal and the condition in which they were dispatched. It is mailed to the superintendent's office for the files of the automatic train control clerk, one copy being retained in the roundhouse foreman's office. In

ROCK ISLAND LINES

SEMI-ANNUAL INSPECTION REPORT AUTOMATIC TRAIN CONTROL
LOCOMOTIVE APPARATUS

INDICATION SELECTOR														Stick Release Switch		Electro-Magnet			
Motor								Clutch Release		Mechanical Lock									
Drop-Away				Pick-Up															
High Speed		Med. Speed		High Speed		Med. Speed		High Speed	Med. Speed	Pick-up		Drop-away		Release		Pick-up		Drop-away	
Volts	Amps.	Volts	Amps.	Volts	Amps.	Volts	Amps.	Amps.	Amps.	Volts	Amps.	Volts	Amps.	Volts	Amps.	Volts	Amps.	Volts	Amps.:

Semi-annual inspection report forwarded to the electrical engineer's office

this way a complete and accurate record of the operation of the automatic train control is compiled.

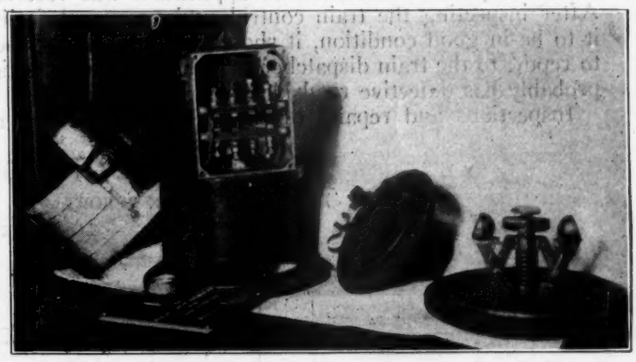
In addition, a report form called "The Record Card" is carried on each locomotive. Any repairs made are noted on this report form each time a locomotive enters a locomotive terminal and at the end of the month the card is removed and mailed to the electrical engineer's office in order that he may have a complete history of the operation of each locomotive at all times.

Thorough knowledge of air brakes essential

To understand, operate and maintain automatic train control intelligently it is imperative that the electrical engineer, train control supervisor, and maintenance forces be thoroughly familiar with the theory of application, maintenance and operation of the air brake systems, not only on the locomotive but upon all rolling stock. They must have an intimate knowledge of locomotive operation and maintenance. They should also have sufficient knowledge of the operation of the signal system upon which the train control has been superimposed to have an understanding as to the control of the roadside element by the signal.

The reservoir and exhaust control valve, which is the air appliance of the automatic train control equipment, is inserted in the air brake lines of the locomotive, and unless the maintainer has sound knowledge of the air brake system, it is easy for him to become confused, resulting in confusion of installation and operation of the air brake equipment of the locomotive as well as of the automatic train control system. For instance, a defective feed valve has caused violent fluctuations of the train line air gage on the locomotive, resulting in the cutting out of the automatic train control by the engineman, and it becomes necessary for the train control forces to be able to detect and explain satisfactorily to the engineman what his trouble actually was. The train control organization must also know the effect of air brake applications upon moving trains, particularly freight trains, and the effects of various reductions and rates of reduction upon the slack action of the trains, as they will be called upon from time to time to discuss these things with enginemen in order to bring about a more complete understanding of train control and its operation.

They must understand locomotive conditions as they develop in operation in order to handle the train control equipment properly. For instance, locomotive tender truck wheels develop flat spots occasionally and begin to pound so severely that the train control attachments become disturbed. They loosen up and the supervisor or maintenance men must pick out these cases for correction by the roundhouse forces. They must be acquainted with all of the government requirements as to clearances, arrangement, etc., that are wrapped about the maintenance of locomotives, so that the train control will not interfere in any way with these requirements. They must work hand in hand with the air brake repairmen and engine inspectors in order that complete co-ordination with air work may result. Their operations must be so conducted as to create a feeling of good fellowship among all concerned.



Parts of speed controller and open view of release box

Battery Applied No.____ Date____

Speed Circuit Controller Set and Tested — Medium____ Date____ Low____ Date____

Form MP 116

Record Card
Automatic Train Control

Month____

Engine No.____

Date Tested — Magnet____ I. S. Relay____ Release Switch____

Speed Circuit Controller Greased (Date)____ R. & B. Valve Cleaned and Tested (Date)____

Date	Brake Appl. Lbs.	Shoe Gauge	Gravity	A. T. C. Working on Arrival	REPORT HERE ANY WORK DONE	Place	Maintainer's Name
1							
2							
3							
29							
30							
31							

Note #1 When changing cards transfer Speed Circuit Controller greasing, setting and testing dates, battery number and application date, R. & B. Valve cleaning and test date, Magnet, I. S. Relay and Release Switch testing date to new card.

Note #2 Speed Circuit Controller must be greased every 60 days, R. & B. Valve cleaned every 6 months, I. S. Relay & Release Switch tested every 12 months, and Magnet tested every 6 months.

Note #3 Forward card from first terminal reached on last day of month to Electrical Engineer, Chicago, Ill. inserting new card as instructed in Note No. 1.

Note #4 Note on back of card any defects or trouble encountered.

Train control record card 8½ in. by 11 in. in size which is carried on each locomotive

Maintainers need working knowledge of signals

The mechanical department automatic train control maintainers should have a working knowledge of that

part of the signal system that controls the roadside elements; that is, they should have a general understanding as to how the different indications are transmitted to the ramp in accordance with the signal indication. This is necessary in order that they can interpret such operations as reported applications of the brakes at a clear signal, etc., particularly where it is the only signal encountered on the trip, at which such an application was received. After inspecting the train control equipment and finding it to be in good condition, it should be possible for them to report to the train dispatcher that the signal in question probably has defective roadside apparatus.

Inspections and repairs of the indication selector, release switch and magnet are reported on one of the forms illustrated, being filled out semi-annually and forwarded to the electrical engineer's office.

The general instructions for automatic train control operation and maintenance are contained in a 38-page pocket size book of rules and instructions issued to all concerned. Electrical engineer's circulars are issued from time to time as necessary, giving detail instructions for the maintenance of the automatic train control equipment. Some important detail instructions for enginemen are contained in an instruction card, illustrated. One of these cards for ready reference is placed in the cab of each locomotive equipped with automatic train control.

R. I. **ROCK ISLAND LINES** Form M. P. 114

DAILY INSPECTION REPORT AUTOMATIC TRAIN CONTROL

LOCOMOTIVE EQUIPMENT

Time 12:01 a. m. to 12:00 p. m. Place_____ Date_____

Eng.	Train In		Train Out	Battery	Ind. Selector	Shoe Box	Stop Ramp Buttons	Release Switch	R & B Valve	Speed Controller	Wiring	Conduit	Piping	Condition When Disp.	Cond. Form M. P. 36	REMARKS
	No.	Interruption														

Total Engines Dispatched_____

Roundhouse Foreman must not O. K. a Train Control Equipped Road Engine for service unless Train Control is in operating condition.

SIGNED: R. H. Foreman_____

R. H. Foreman_____

Maintainer_____

Maintainer_____

Inspection report filled out daily by enginemen on arrival of locomotives at terminal points

Train control assists mechanical and operating men

The results of the operation of train control are particularly interesting and important to the mechanical department. It is permissible for trains hauled by locomotives equipped with automatic train control in operating condition to pass an automatic stop signal indicating "Stop" without bringing the train to a full stop, as a reduction to below the low prescribed speed limit of 15 miles an hour, and the continuous control of this speed through the red block, has obviated such a necessity. All mechanical men, traveling engineers, road foremen of equipment, etc., fully realize the importance of not bringing a train to a stop except when absolutely necessary. The elimination of unnecessary stops results in economy of fuel, reduces the number of drawbars pulled out and lessens wear and tear on equipment, such as draft gear, drawbars, knuckle pins, brake riggings, etc., all of which helps to reduce operating and maintenance costs.

The automatic train control clerk in the division superintendent's office is constantly in close touch with the entire train control situation through the chief dispatcher, also directly by telephone or telegraph with the shop and roundhouse foremen, and in daily contact with the trainmaster. This close contact, together with the regular form reports, including emergency or trouble wire reports, enables the automatic train control clerk to keep a close check on each individual locomotive and signal equipped with automatic train control, handling any trouble for immediate correction. At the end of the month he makes an analysis sheet from his daily records kept for each locomotive, etc., and from this analysis sheet forms his monthly report for the chief operating officer and the Interstate Commerce Commission.

These monthly reports on the Rock Island show a steady improvement in both operation and maintenance as our knowledge of the equipment increases.

Jig for planing the boiler radius on cylinder saddles

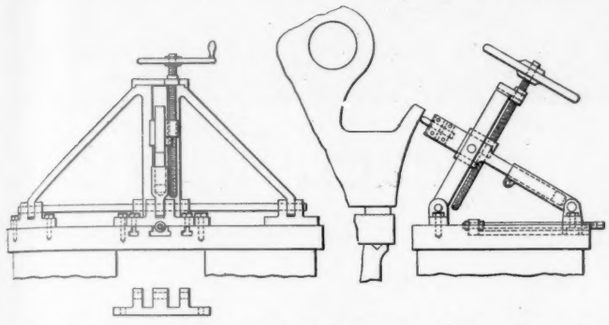
By C. G. Williams

ONE of the numerous problems of railroad shop work is the replacement of cylinders in cases where the originals have been worn out, broken or where replacement has become necessary in order to eliminate the old slide valves. The main item is the cost of finishing the saddles to fit the radius of the boiler. This operation has been performed in various ways, from chipping with a hammer and chisel or by using an air hammer, to planing slots to the layout lines on a planer and then chipping out the bridges with a hand chisel and sledge. The finishing has then been done with an air hammer or by attempting to follow the radius with a planer tool. This is a tedious and inaccurate job and costs money.

The Hoisington, Kans., shops of the Missouri Pacific has devised a practical and quick method for doing this work by the use of the fixture shown in the sketch. This fixture is placed on a heavy face plate, 8 ft. by 3 ft. 6 in., and 8 in. thick. It is placed on two concrete pillars set parallel with the bed of the planer which is used to plane up the backs of the cylinders and the plate is located about two inches lower than the top of the planer bed. This permits the center of the pin to go through the end of the radius bar about two inches higher than the bed of the planer and also allows the machinist to use two-inch parallels under the back of the

cylinder. The radius bar is then set to the radius of the smokebox and the saddle is planed to fit.

No provision was made in the original fixture to allow for lengthening the radius bar to suit the various radii, other than the slight amount that the yoke might be raised, or the cylinder set back from the edge of the planer bed, because the fulcrum was fixed. The writer has suggested an improvement in the drawing which will give a variable fulcrum by sliding the base of the radius bar by the use of a screw.



Sketch showing the construction of a jig for planing the radius on cylinder saddles

This improvement has been recommended by the shop officers to be incorporated in the original fixture so that it can be used for planing cylinders on the largest power now in use on this road. Another improvement is the graduation of the sliding member of the radius bar so that the radius may be determined directly from the bar and not by the use of a tram.

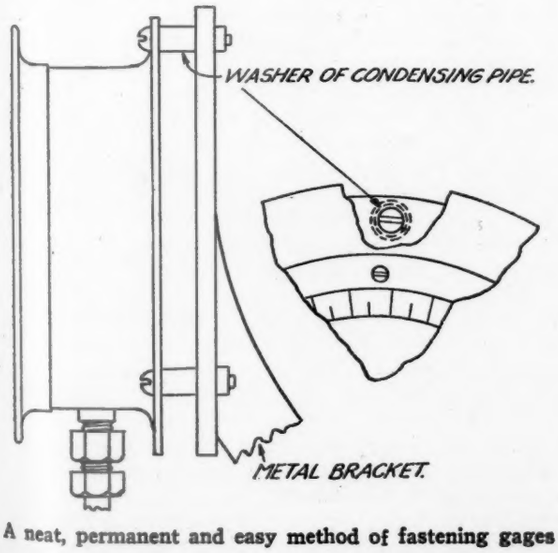
With this fixture it is possible to plane a pair of cylinder saddles to the correct boiler radius in five hours.

Method of applying gages to eliminate vibration

By Frank Bentley

Machinist, Chicago & North Western, Missouri Valley, Iowa

THE two common methods of securing air and steam gages, though expedient for fastening the gages in place, are not very permanent. If wooden washers or clips are used between the gage casing and the metal bracket, they are prone to split, which results in a loose, rattling gage. More particularly is this the case when the location of the gage subjects it to heat and vibration. If it is to be installed on a wall or wooden surface, the usual practice is to make a block near in size to the diameter of the back of the casing. This is, of course, fastened to the wall and the gage to the block, to permit free access to the connecting nipple. If the block is not carefully made an untidy job is the result, in addition to the liability of splitting, as several screws are applied in putting the two pieces in place.



A neat, permanent and easy method of fastening gages

The illustration shows a simple way of fastening gages which is neat, permanent, and easily done. Short pieces of old lubricator condensing pipes are sawed off, squared on a file, and used to block out the gage. It is held against these pieces by the casing screws or bolts. The small pieces of the brass condensing pipe do not protrude over the circumference of the casing or body. They are light and take paint or bronze readily, and will not break or crack under heat or vibration. They can be used to secure the gage to a wooden surface of any kind without splitting it. They can be cut any desired length, and afford a strong back support for a fairly large gage.

Locomotive valve setting chart

A CONVENIENT form for keeping a record of the valve setting on locomotives is shown in the drawing. This form can be drawn on a tracing in the drafting room from which blue print copies may be made. The chart is

LOCOMOTIVE VALVE SETTING CHART

ENGINE NUMBER _____ DATE _____

VALVES SET BY _____ FOREMAN IN CHARGE _____

FORWARD MOTION				BACK MOTION				TRAVEL OF VALVE AT FULL GEAR			
RIGHT SIDE		LEFT SIDE		RIGHT SIDE		LEFT SIDE		FORWARD MOTION		BACK MOTION	
FRONT END OF CYL.	BACK END OF CYL.	FRONT END OF CYL.	BACK END OF CYL.	FRONT END OF CYL.	BACK END OF CYL.	FRONT END OF CYL.	BACK END OF CYL.	R.S.	L.S.	R.S.	L.S.
PRE-ADMISSION, RELEASE AND COMP, FULL GEAR, FORWARD MOTION				PRE-ADMISSION, RELEASE AND COMP, AT CUT-OFF, FORWARD MOTION							

LEAD AT FULL GEAR

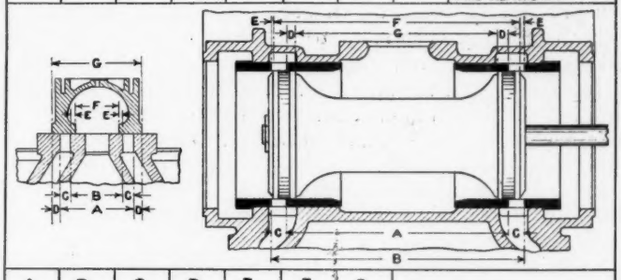
LEAD AT CUT-OFF 25% ON PASSENGER ENG'S. 50% ON FRT. & YD. ENG'S.

CUT-OFF

RELEASE

COMPRESSION

PRE-ADMISSION



A	B	C	D	E	F	G	
							RIGHT SIDE OF ENGINE
							LEFT SIDE OF ENGINE

NOTE:- WHEN THE EXHAUST LAP IS POSITIVE, (AS SHOWN IN DIAGRAM OF SLIDE VALVE) PUT A + SIGN BEFORE DIMENSION FILLED IN FOR "E" IN TABLE. WHEN THE EXHAUST LAP IS NEGATIVE (AS SHOWN IN DIAGRAM OF PISTON VALVE) PUT A − SIGN BEFORE DIMENSION FILLED IN FOR "E" IN TABLE

A convenient form for keeping a record of the valve setting of locomotives

filled out by the mechanic who sets the valves and duplicate copies for the mechanical engineer and master mechanic are typewritten. This record is valuable in checking cases where locomotives have not been working properly and readjustments of the valve gear are desired. It is also convenient to have such a record available for purposes of comparing locomotives with others of the same class.

The year's purchases of machine tools

Lists from 85 roads indicate a $14,000,000 expenditure; Demand likely to be greater in 1925

By L. R. Gurley

USING as a basis figures submitted by a group of railroads representing over 50 per cent of the track mileage in the United States, Canada and Mexico, it has been estimated that during the past year the railroads of North America spent approximately $14,400,000 for machine tools. Such budget figures as are available indicate that the railroads of the same territory will spend about $17,000,000 for shop machinery in 1925, which will exceed last year's expenditures by $2,600,000. The rapidly rising business barometer indicates that this figure may even be exceeded if the financial situation of the roads proves stronger in 1925 than in 1924.

On page 101 of the January 3 issue of the Railway Age will be found an article on "Machine Tools Purchased During 1924" which contains two tables giving in total numbers the various types of machines purchased by approximately 100 railroads of North America. These figures show that the railroads purchased 337 lathes, 178 drill presses, 127 planers, shapers and slotters, 80 boring mills, 50 milling machines, 240 grinding machines, 96 bolt and pipe cutting and threading machines, 51 portable boring facing and turning machines, 78 power presses, 54 hammers and forging machines, 108 boiler shop machine tools, including punches and shears, 64 flue shop machines and 146 wood working machines. The lists of machine tools here shown give in detail the size and capacity of the individual tools, as well as the name of the builder or dealer from whom they were purchased.

As might be expected, the lathe leads all other types of machine tools in the number purchased. Of the total of 337 lathes purchased, 209 are engine lathes. It is interesting to note that 93 turret lathes were purchased, which seems to indicate a real growth in the extent to which work is being put on a production basis. The indispensable drill press ranks next in importance to the lathe. From the data submitted, it was found that the smaller, belt driven, drill presses are being replaced by powerful, high-speed, motor driven machines. The last 15 years has witnessed an immense increase in the size of locomotives which has led to the adoption of large steel castings, some of alloy steel, and alloy steel forgings. Twist drill manufacturers have developed high-speed drills to handle these materials effectively, and it is being realized that it is false economy to use machines which will not pull these drills.

During the past few years considerable has been written and said about the place the grinding and milling machines would take in the railroad shops. A machine tool expert of one of the largest railroads of the country recently stated that in future years milling and grinding machines will rank in importance next to the lathe and the drill press. The railroads purchased 240 grinders of which 50 were precision machines and the remainder, tool and floor grinders. They also purchased 50 milling machines. These figures indicate a well defined trend in the direction of the above forecast.

The railroads purchased 80 boring mills of which 64 were of the vertical and 16 of the horizontal type. The latter apparently is used to handle a variety of general work while the former is used for production work.

It is evident that the slotter is being replaced by tools of other types. Only 13 are included in the lists. The planer and the shaper, however, hold places of importance in the purchases of the railroads. The lists include 40 planers and 74 shapers.

A total of 78 power presses were purchased during the past year. The presses shown in the accompanying lists are divided between those of high capacity for wheels and comparatively light bushing presses. Again, the increase in the size of locomotives has resulted in increasing the pressures required for forcing off and on wheels, crank pins and bushings which can not be efficiently done on presses that were installed 15 or 20 years ago to handle the smaller class of rolling equipment in use at that time.

The flue and boiler shops were equipped with a considerable number of new machines during 1924. Flue welders, mainly the electric type, received considerable attention as a necessary addition to a modern flue shop. The flanger and forming rolls with a scattering of riveters constituted the bulk of the purchases.

In spite of the tendency to change wooden cars to steel construction, 146 units of woodworking machinery were bought during the past year. Wooden passenger cars are fast disappearing, but it will be many years before all freight cars are built of steel. Consequently, the demand for woodworking machinery will continue.

A few of the large railroads of the country declined to report while others sent in no reports of any kind. Still others reported no purchases during 1924.

A list of the machine tools (metal cutting and forming) purchased by the railways during 1924

Alabama & Vicksburg

No.	Size and capacity	Type of machine	Builder or dealer
1	No. 379-B	Vert. hollow chisel mortising mach.	J. A. Fay & Egan Co.
1	No. 6	Single cylinder surface planer	J. A. Fay & Egan Co.
1	No. 345	Band sawing machine	J. A. Fay & Egan Co.
1	No. 414	Universal woodworker	J. A. Fay & Egan Co.

Atchison, Topeka & Santa Fe

No.	Size and capacity	Type of machine	Builder or dealer
1		Axle journal turning lathe	Niles-Bement-Pond Co.
2		Double end car axle lathes	Niles-Bement-Pond Co.
1	14-in. by 6-ft.	Portable engine lathe	Manning, Maxwell & Moore
3	16-in. by 6-ft.	Portable engine lathes	Manning, Maxwell & Moore
7	16-in. by 6-ft.	Portable engine lathes	Herberts Machinery & Supply Co.
1	16-in. by 8-ft.	Engine lathe	Manning, Maxwell & Moore
1	16-in. by 8-ft.	Engine lathe	Hendey Machine Co.
2	20-in. by 8-ft.	Engine lathes	Manning, Maxwell & Moore
1	20-in. by 12-ft.	Engine lathe	Manning, Maxwell & Moore
2	20-in. by 18-ft.	Engine lathes	Manning, Maxwell & Moore
1	21in. by 16-ft.	Engine lathe	Louis G. Henes
1	23-in. by 10-ft.	Engine lathe	Niles-Bement-Pond Co.
1	23-in. by 12-ft.	Engine lathe	Niles-Bement-Pond Co.
1	24-in. by 12-ft.	Engine lathe	Manning, Maxwell & Moore
1	24-in. by 14-ft.	Engine lathe	Jos. T. Ryerson & Son
1	26-in. by 12-ft.	Engine lathe	Manning, Maxwell & Moore
1	30-in. by 12-ft.	Engine lathe	Niles-Bement-Pond Co.
1	30-in. by 24-ft.	Engine lathe	Harron, Richard & McCone Co.
1	36-in. by 16-ft.	Engine lathe	Manning, Maxwell & Moore
1	42-in. by 14-ft.	Engine lathe	Harron, Richard & McCone Co.
1	48-in. by 16-ft.	Engine lathe	Harron, Richard & McCone Co.
1	2-in. by 24-in.	Turret lathe	Jones & Lamson Machine Co.
1	2¼-in. by 24-in.	Turret lathe	Jones & Lamson Machine Co.
1	2¾-in. by 26-in.	Flat turret lathe	Jones & Lamson Machine Co.
1	12-in. by 6-ft.	Turret lathe	Hendrie & Bolthoff M. & S. Co.
2	16-in. by 6-ft.	Turret lathes	Manning, Maxwell & Moore.
2	18½-in. by 6-ft.	Turret lathes	Warner & Swasey Co.
1	21-in. by 8-ft.	Turret lathe	Waterhouse & Lester Co.
1	25-in. by 10-ft.	Turret lathe	Waterhouse & Lester Co.
1		Turret lathe	Harron, Richard & McCone Co.
1		Universal turret lathe	Hendrie & Bolthoff M. & S. Co.
1		Wheel journal truing machine	Niles-Bement-Pond Co.
1	54-in.	Tire turning lathe	Niles-Bement-Pond Co.
2		Nut facing machines	Herberts Machinery & Supply Co.
1	4-ft.	Radial drill	E. L. Essley Machinery Corp.
1	5-ft.	Radial drill	Smith-Booth-Usher Co.
1	5-ft.	Radial drill	E. L. Essley Machinery Corp.
1	6-ft.	Radial drill	Manning, Maxwell & Moore
1	6-ft.	Radial drill	Smith-Booth-Usher Co.
1	6-ft.	Radial drill	E. L. Essley Machinery Corp.
1	6-ft.	Drilling and tapping machine	Smith-Booth-Usher Co.
1	7-ft.	Radial drill	Smith-Booth-Usher Co.
1		Radial drill and tapper	Marshall & Buschart Mchy. Co.
1	20-in.	Drill press	E. L. Essley Machinery Corp.
5	24-in.	Upright drill presses	E. L. Essley Machinery Corp.
5	24-in.	Motor driven drill presses	E. L. Essley Machinery Corp.
2		Vertical drill presses	Consolidated Mach. Tool Corp.
1		Upright drill press	E. L. Essley Machinery Corp.
1	16-in.	Sensitive floor drill	Crerar, Adams & Co.
1	24-in.	Bench drill	E. L. Essley Machinery Corp.
1	24-in.	Sensitive drill press	E. L. Essley Machinery Corp.
1		Sensitive drill press	Manning, Maxwell & Moore
1		Feed drill	Manning, Maxwell & Moore
1		Drill press	Consolidated Mach. Tool Corp.
1	36-in. by 36-in by 12-ft.	Metal planer	Herberts Machinery & Supply Co.
1	24-in.	Pillar shaper	Harron, Richards & McCone Co.
1	24-in.	Crank shaper	Harron, Richards & McCone Co.
2	36-in.	Pillar shapers	Morton Manufacturing Co.
2	36-in.	Draw cut shapers	Morton Manufacturing Co.
1	26-in.	Crank slotter	T. C. Dill Machine Co.
1		Horizontal boring mill	Lucas Machine Tool Co.
1	42-in.	Boring mill	Consolidated Mach. Tool Corp.
1	50-in.	Vertical boring mill	Waterhouse & Lester Co.
1	96-in.	Boring mill	Herberts Machinery & Supply Co.
1	96-in.	Boring and turning mill	Herberts Machinery & Supply Co.
1	100-in.	Boring and turning mill	Herberts Machinery & Supply Co.
1		Drilling and boring machine	Niles-Bement-Pond Co.
1		Car brass boring machine	Ar-An-Ess Mfg. Co.
1		Horizontal milling machine	Marshall & Huschart Mchy. Co.
1		Milling machine	Brown & Sharpe Mfg. Co.
1		Milling machine	Harron, Richard & McCone Co.
1		Vertical milling machine	Harron, Richard & McCone Co.
1		Portable milling machine	E. L. Ruby
1		Die making machine	E. L. Essley Machinery Corp.
1		Broaching machine	Harron, Richard & McCone Co.
1		Piston rod grinding machine	Landis Tool Works
3		Grinding machines	Heald Machine Co.
1		Radius link grinding machine	Manning, Maxwell & Moore
1	12-in. by 40-in.	Grinding machine	Harron, Richard & McCone Co.
1	84-in. by 23⅛-in.	Guide grinder	E. L. Essley Machinery Corp.
1	84-in by 24⅜-in.	Guide grinder	E. L. Essley Machinery Corp.
1		Surface grinding machine	Brown & Sharpe
1		Surface grinder	Herberts Machinery & Supply Co.
1		Single end wet emery grinder	Manning, Maxwell & Moore
12		Double end wet emery grinders	Marshall & Huschart Mchy. Co.
4		Double end dry emery grinders	Marshall & Huschart Mchy. Co.
1		Saw sharpener and grinder	Machinery Corp. of America
1		Band saw filing and setting mach.	E. L. Essley Machinery Corp.
2		Band saw sharpeners	Sam C. Rogers & Co.
1	3/32-in. to 4-in.	Drill grinder	Herberts Machinery & Sup. Co.
1		Cold saw	Niles-Bement-Pond Co.
1		Draw cut hack saw	Herberts Machinery & Sup. Co.
1	90-in.	Quartering machine	Niles-Bement-Pond Co.
1		Portable loco. cyl. boring bar	Manning, Maxwell & Moore
1		Portable loco. cyl. boring bar	Manning, Maxwell & Moore
1		Portable valve chamber boring bar	H. B. Underwood Corp.
1		Bolt cutter	Landis Machine Co.
1		Pipe cutting machine	Manning, Maxwell & Moore
1		Pipe machine	E. L. Essley Machinery Corp.
1		Pipe threading machine	E. L. Essley Machinery Corp.
1		Pipe threading machine	H. Channon Co.
3		Crank pin presses	Watson-Stillman Co.
1	1,500-lb.	Steam hammer	Niles-Bement-Pond Co.
1	4,000-lb.	Double frame hammer	Niles-Bement-Pond Co.
1	3½-in.	Forging machine	Ajax Manufacturing Co.
1		Punching machine	Herberts Machinery & Sup. Co.
1	42-in.	Squaring shear	E. L. Essley Machinery Corp.
1	8-ft.	Squaring shear	E. L. Essley Machinery Corp.
1		Circular shear	E. L. Essley Machinery Corp.
1		Staybolt nipper	Jos. T. Ryerson & Son
2		Cornice brakes	Louis G. Henes
1		Safe end cutter	Jos. T. Ryerson & Son
1		Auto. safe end cut off machine	Jos. T. Ryerson & Son
2		Flue cutters	Jos. T. Ryerson & Son
2		Flue swedging machines	Jos. T. Ryerson & Son
4		Flue welding machines	Jos. T. Ryerson & Son
1		Flue welding machine	Thomson Electric Welding Co.
2		Saw and tube expanders	Jos. T. Ryerson & Son
2	24-ft.	Flue rattlers	Baird Pneumatic Tool Co.
2		Flue polishing machines	Peerless Surfacing Machine Co.
1		Flue polishing machine	Production Machine Co.
1		Hydraulic pipe bending machine	Watson-Stillman Co.
1		Pipe bending machine	Watson-Stillman Co.
2		Adjustable bending machines	Herberts Machinery & Supply Co.
1		Pipe bending machine	Pedrick Tool & Machine Co.
1	10-ft.	Plate flanging clamp	Consolidated Mach. Tool Corp.
1	20-ft.	Plate flanging clamp	Consolidated Mach. Tool Corp.
1	1¼-in. by 30-in.	Roll forming machine	Peck, Stow & Wilcox Co.
1	4-in. by 60-in.	Roll forming machine	Smith-Booth-Usher Co.
1		Angle iron bending roll	Miles Machinery Co.
1		Brake and folding machine	E. L. Essley Machinery Corp.
1		Power mortiser	American Wood Working Mchy. Co
1	24-in. by 7-ft.	Single surfacer	Eby Machinery Co.
1	24-in.	Swing cut-off saw	J. A. Fay & Egan Co.
1	36-in.	Hand feed rip saw	J. A. Fay & Egan Co.
1	16-ft.	Rip and cut-off saw	Oliver Machinery Corp.
1		Rip and cut-off saw	Greenlee Bros. Co.
1		Rip and cut-off saw	Oliver Machinery Co.
1		Band resaw stretcher and shear	Machinery Corp. of America
1	4-sided	Molder	J. A. Fay & Egan Co.
1		Drum and disk sander	J. A. Fay & Egan Co.
1		Sand blast equipment	Kirk & Blum Manufacturing Co.

Atlanta & West Point

No.	Size and capacity	Type of machine	Builder or dealer
1	2¼-in. by 24-in.	Turret lathe	Jones & Lamson Mach. Co.
1	42-in.	Band saw	Manning, Maxwell & Moore
1		Duplex adjust. bending mach.	James R. Kerling

Atlantic City Railroad

No.	Size and capacity	Type of machine	Builder or dealer
1	20-in.	Vertical drill press	Rockford Machine Tool Co.

Atlantic Coast Line

No.	Size and capacity	Type of Machine	Builder or dealer
1	14-in. by 6-ft.	Portable lathe	Bradford Machine Tool Co.
1	34-in.	Drill press	W. F. & John Barnes Co.
1	34-in.	Drill press	W. F. & John Barnes Co.
1	36-in. by 42-in. by 8-ft.	High speed planer	Jos. T. Ryerson & Son
1	30-in. by 30-in. by 16-in.	Slab miller	Ingersoll Milling Mach. Co.
1		Universal grinder	Gallmeyer & Livingston Co.
1		Drill grinder	Wm. Sellers & Co.
1		Cylinder boring bar	H. B. Underwood Corp.
1		Pipe cutting machine	Walworth Manufacturing Co.
1	6-spindle	Staybolt machine	Harrington Co.
1		Pneumatic mud ring riveter	W. F. Allen & Co.
1	1-in.	Lattice riveter	Manning, Maxwell & Moore
1		Portable riveter	W. F. Allen & Co.

Baltimore & Ohio

No.	Size and capacity	Type of machine	Builder or dealer
1		Journal truing lathe	Manning, Maxwell & Moore
1		Axle lathe	Betts Machy. Co.
1	16-in. by 6-ft.	Engine lathe	Kemp Machy. Co.
1		Heavy duty engine lathe	Aumen Machy. Co.
1	42-in.	Turret lathe	Bullard Mach. Tool Co.
1		Radial drill	Sherritt & Storer Co., Inc.
1	20-in.	Upright drill press	Kemp Machy. Co.
1		Radial drill press	Aumen Machy. Co.
2		Drill presses	Colburn Mach. Tool Co.
1		Self centering machine	Laughlin & Barney Co.
2	28-in.	Columbia crank shapers	Manning, Maxwell & Moore
3		Car wheel boring mills	Wm. Sellers & Co.
1		Reseating machine	Lagonda Manufacturing Co.
1		Guide bar grinder	Sherritt & Storer Co.
1		Tool Grinder	Wm. Sellers & Co.
1		Twist drill grinder	Sherritt & Storer Co.
1		Drill grinder	Niles-Bement-Pond Co.
1		Universal grinder	Kemp Mach. Co.
1		High speed power saw	Aumen Machy. Co.
1		High speed metal saw	L. A. Benson Co.
1		Metal cutting saw	Fairbanks, Morse & Co.
1		Cylinder boring bar	Manning, Maxwell & Moore
1	4½-in. by 6-ft.	Portable boring bar	Manning, Maxwell & Moore
1		Portable crank pin truing mach.	H. B. Underwood Corp.
4		Dome facing machines	Manning, Maxwell & Moore
3	1-in.	National bolt cutters	Manning, Maxwell & Moore
1	4-spindle	Bolt turning machine	Wm. H. Foster Co.
1		Pipe threading machine	L. A. Benson Co.
1		Pipe machine	Jarecki Manufacturing Co.
1	Large	Rip saw	I. A. Fay & Egan Co.
1		Cut-off saw	I. A. Fay & Egan Co.
1		Tochey timber dapper	National Con. Mach. Co.

Bangor & Aroostook

No.	Size and capacity	Type of machine	Builder or dealer
1	36-in. by 12-ft.	Heavy pattern planer	Manning, Maxwell & Moore
1	11/32-in.	Bench drill	Manning, Maxwell & Moore
1		Floor grinder	Hisey-Wolf Machine Co.
1	1-in.	Vertical punch and shear	Manning, Maxwell & Moore

Boston & Albany

No.	Size and capacity	Type of machine	Builder or dealer
1	13½-in.	Axle lathe	Betts-Bridgeford Co.
1	14½-in.	Engine lathe	American Tool Works Co.
1	24-in. by 7-ft.	Engine lathe	Bradford Machine Tool Co.
2	36-in. by 7-ft.	Engine lathes	Bradford Machine Tool Co.
1		Rotary valve planer	H. B. Underwood Corp.
1	30-in.	Rotary valve seat planer	H. B. Underwood Corp.
1	36-in.	Draw cut shaper	Morton Manufacturing Co.
1	32-in.	Shaper	Gould & Eberhardt
1	24-in	Shaper	Stockbridge Machine Co.
1	24-in.	Shaper	Gould & Eberhardt
1	18-in.	Slotter	Dill Machine Co.
1		Horizontal boring machine	Lucas Machine Tool Co.
1	No. 6	Double emery grinder	Bridgeport Safety Em'y Wheel Co.
1		Double floor grinder	Bridgeport Safety Em'y Wheel Co.
2		Universal knife grinders	American Woodworking Mach. Co.
1		Metal cutting band saw	
1	500-lb.	Bradley hammer	Manning, Maxwell & Moore
1	2½-in.	Forging machine	Ajax Manufacturing Co.
1		Forging machine	Ajax Manufacturing Co.
1		Squaring shear	Manning, Maxwell & Moore
1	8-ft.	Flanging clamp	Wickes Brothers
1		Vertical staybolt drill	Manning, Maxwell & Moore
1		Vertical boring machine	Greenlee Bros., & Co.
1		Planer and timber sizer	Yates Machine Co.

Central Railroad of New Jersey

No.	Size and capacity	Type of machine	Builder or dealer
1	4½-in.	Turret lathe	Warner & Swasey Co.
1	7-in.	Precision cutter grinder	W. O. Barnes & Co.
1	100-ton	Bushing press	Watson-Stillman Co.
1	5½-in.	Pneumatic tube welding mach.	Draper Manufacturing Co.

Chesapeake & Ohio

No.	Size and capacity	Type of machine	Builder or dealer
1	16-in. by 8-ft.	Engine lathe	Hendey Machine Co.
2	42-in.	Vertical turret lathes	Bullard Machine Tool Co.
1	2¼-in. by 24-in.	Flat turret lathe	Warner & Swasey Co.
1	42-in.	Car Wheel lathe	Wm. Sellers & Co.
1	32-in. by 32-in. by 39½-in.	Planer	Newton Machine Tool Works
1	36-in.	Drawcut shaper	Morton Manufacturing Co.
1		Boring and facing machine	Wm. Sellers & Co.
1	16-in. by 8-in. by 4-in.	Slab mill	Goddard & Goddard
2	36-in. by 4-in.	Wet tool grinders	Diamond Machine Co.
1	2¾-in.	Drill pointing machine	Oliver Instrument Co.
1		Reamer and cutter grinder	Brown & Sharpe Mfg. Co.
1	3/32-in. to 3½-in.	Twist drill grinder	Wilmarth & Morman Co.
1	13-in. by 16-in.	Metal sawing machine	Peerless Machine Co.
2	6-in.	Power hack saws	Racine Tool & Machine Co.
1	90-in.	Wheel quartering machine	Niles-Bement-Pond Co.
1	12-in. by 18-in.	Crank pin turning machine	H. B. Underwood Corp.
3	100-ton	Hydraulic presses	Chambersburg Engineering Co.
1	1-in. to 4-in.	Pipe threading machine	Oster Manufacturing Co.
1	36-in.	Squaring shear	Niagara Punch & Shear Co.
2	4½-in by 8-in to 6-in. by 11-in.	Journal bearing machine	Ar-An-Ess Mfg. Co.
4	½-in. to 6-in.	Tube cutting machines	Jos. T. Ryerson & Son
2	96-in.	All steel bending brakes	Dreis & Krump Mfg. Co.
1		Adjusting machine	Walter Stock Adj. Mach. Co.

Chicago & Alton

No.	Size and capacity	Type of machine	Builder or dealer
1	¼-in. to 3-in.	Pipe cutting machine	Jarecki Manufacturing Co.

Chicago, Burlington & Quincy

No.	Size and capacity	Type of machine	Builder or dealer
1	16-in. to 20-in.	Engine, lathe	
2		Vertical drill presses	
1		Car wheel boring mill	
3		Car brass boring machines	
1		Splice bar milling machine	
3		Dry grinders	
1		Cutter grinder	
1		Bolt threading machine	
1		Pipe threading machine	
1		Helve hammer	
2		Bulldozers	
1		Bolt straightener	
2		Punching machines	
4		Shears	
1		Portable shear	
1		Squaring shear	

1	42-in.	Car wheel lathe	Wm. Sellers & Co.
1	21½-in.	Turret lathe	Warner & Swasey Co.
2	5-ft.	Radial drills	American Tool Works Co.
1	32-in.	Shaper	Stockbridge Machine Co.
1	2-in.	Triple head bolt cutter	Acme Machine Co.
1	2¼-in.	Triple head bolt cutter	Acme Machine Co.
1	75-ton	Hydraulic press	Chambersburg Engineering Co.
1		Punch	Long & Allstatter Co.
1		Shear	Long & Allstatter Co.
1		Electric flue welder	Thomson Electric Welding Co.
1		Surfacer	J. A. Fay & Egan Co.

Boston & Maine

No.	Size and capacity	Type of machine	Builder or dealer
2		Double axle lathes	Manning, Maxwell & Moore
1	3-in. by 36-in.	Turret lathe	Jones & Lamson Mach. Co.
2	6-ft.	Radial drills	Thomson Co.
1	42-in.	Upright drill	Barnes Manufacturing Co.
1	30-in.	Morton draw cut shaper	Manning, Maxwell & Moore
2	40-in.	Car wheel borers	Manning, Maxwell & Moore
1		Driving box boring mill	Bullard Mach. Tool Co.
1		Cincinnati milling machine	Henry Prentiss Co.
1		Internal grinding machine	Heald Mach. Co.
1	5-valve	Valve finishing machine	Walter H. Foster Co.
1		Drill point grinder	Taylor Machine Co.
1	20-in.	Grinding wheel	Norton Co.
1	20-in.	Grinder	Norton Co.
1		Power hack saw	Taylor Mach. Co.
1	400-ton	Chambersburg wheel press	Manning, Maxwell & Moore
1	100-ton	Hydraulic driving box press	Bullard Mach. Tool Co.
1	¾-in.	Cross cutting shear	Long & Allstatter Co.
1	97-in.	Power squaring shear	Niagara Mach. & Tool Co.
1	36-in.	Punch and shear	Long & Allstatter Co.
1		Electric flue welder	Thomson Electric Weld. Co.
1		Adjusting machine	Walter Stock Adj. Mch. Co.
1	36-in.	Band saw	American Woodworking Mach. Co.

Canadian Pacific

No.	Size and capacity	Type of machine	Builder or dealer
1		Double car axle lathe	J. Bertram & Sons
1		Car axle lathe	Canadian Machy. Corp.
1	20-in. by 8-ft	Engine lathe	Canadian Machy. Corp.
1	24-in. by 10-ft	Engine lathe	J. Bertram & Sons
1	24-in. by 12-ft	Engine lathe	Canadian Machy. Corp.
1	26-in. by 12-ft	Engine lathe	Canadian Machy. Corp.
1	32-in. by 14-ft	Engine lathe	J. Bertram & Sons
1	36-in. by 12-ft	Engine lathe	Canadian Machy. Corp.
2	5-in.	Turret lathes	Alfred Herbert, Ltd.
1	42-in.	Vertical turret lathe	Bullard Mach. Tool Co.
1	54-in.	Vertical turret lathe	Bullard Mach. Tool Co.
1	42-in.	Car wheel lathe	J. Bertram & Sons
1	52-in.	Car wheel lathe	J. Bertram & Sons
1	30-in.	Vertical drill press	Canadian Machy. Corp.
1	36-in. by 18-ft	Frog and switch planer	J. Bertram & Sons
4	32-in.	Shapers	J. Bertram & Sons
1	84-in.	Guide bar grinder	Bridgeport Safety Emery Wheel Co.
1	2-spindle	Vertical grinder	Beyer Peacock & Co.
1		Cylinder grinder	Churchill Mach. Tool Co., Ltd.
1		Surface grinder	Blanchard Mach. Co.
1		Double floor grinder	Ford-Smith Co.
1		Cutter and reamer grinder	Cincinnati Milling Mach. Co.
1		Hack saw	Racine Tool & Mach. Co.
1	2-in.	Pipe cutting machine	A. R. Williams
1	100-ton	Axlebox press	J. Bertram & Sons
1		Bull lozer	Ajax Mfg. Co.
1		Double punch and shear	Craig & Donald
1		Power shear	Brown & Boggs
1	1-in. cap.	Flanging machine	McCabe Mfg. Co.
1	24-ft.	Flue cleaning machine	Draper Mfg. Co.

Central of Georgia

No.	Size and capacity	Type of machine	Builder or dealer
1	12-in.	Portable engine lathe	American Tool Works
1	90-in.	Journal turning lathe	Niles-Bement-Pond Co.
1	12-in.	Lathe	American Tool Works
1	16-in.	Toolroom lathe	Hendey Machine Co.
1	16-in.	Lathe	American Tool Works
1	18-in.	Lathe	American Tool Works
1	14-in.	Sensitive drill	
2		Bull riveters	
2		Pinch-bug riveters	
1		Rip saw	

Chicago Great Western

No.	Size and capacity	Type of machine	Builder or dealer
2	18-in. by 8-ft.	Engine lathes	Hill, Clarke & Co.
2	24-in. by 12-ft.	Engine lathes	Hill, Clarke & Co.
1	4-spindle	Valve grinding machine	Automatic Valve Grind. Mach. Co.
1		Tool post grinder	Western Electric Co.

Chicago, Indianapolis & Louisville

No.	Size and capacity	Type of machine	Builder or dealer
1	12-in. by 2-in. by 1-in.	Wet and dry grinder	Crerar-Adams & Co.
1	⅛-in. to ¼-in.	Metal cutting band saw	E. C. Atkins Co.
1	24-in	Cut-off saw	Van Camp Hardware & Iron Co.
1	36-in.	Car rip saw bench	Greenlee Bros., & Co.

Chicago, Rock Island & Pacific

No.	Size and capacity	Type of machine	Builder or dealer
3	14-in. by 13-in.	Axle lathes	Niles-Bement-Pond Co.
1	24-in. to 26-in.	Turret lathe	International Mach. Tool Co.
1	1¾-in., 4-spindle	Automatic screw machine	National Acme Co.
1	8-in.	Single spindle high speed drill	Sipp Machine Co.
1	3¾-in. by 7-in. and 4¼-in. by 8-in.	Car wheel boring machine	Davis Boring Tool Co.
1	4-in. by 8-ft.	Cylinder boring machine	H. B. Underwood Corp.
1	58-in. by 16-ft.	Horizontal rod milling machine	Niles-Bement-Pond Co.
2		Horizontal milling machines	Cincinnati Milling Mach. Co.
1	¼-in. to 2¾-in.	Automatic drill pointer	Oliver Instrument Co.
2	48-in., 400-ton	Car wheel presses	Niles-Bement-Pond Co.
1	38-in., 20-ton	Arbor press	Atlas Press Co.
1	1-in. to 2-in.	Pipe bending machine	H. B. Underwood Corp.
1	4-spindle	Car boring machine	Greenlee Bros. & Co.
1	14-in. by 16-in.	Car mortiser	Greenlee Bros. & Co.
1	1-in.	Mortising machine	Greenlee Bros. & Co.
1	5-in. by 20-in.	Cabinet tenoning machine	J. A. Fay & Egan Co.
1	36-in.	Automatic cut-off machine	Greenlee Bros. & Co.
1	42-in.	Band saw machine	J. A. Fay & Egan Co.
1	32-in.	Rip saw	Greenlee Bros. & Co.

Chicago & Western Indiana

No.	Size and capacity	Type of machine	Builder or dealer
1	3-ft.	Radial drill	American Tool Works
1		Vertical drill	Foote-Burt Co.
1	2-in.	Singlehead bolt threader	Landis Machine Co.
1	2-in.	Boring and mortising machine	Greenlee Bros. & Co.
1	36-in.	Cut-off saw	J. A. Fay & Egan Co.
1	30-in.	Rip saw	Greenlee Bros. & Co.

Cincinnati, Indianapolis & Western

No.	Size and capacity	Type of machine	Builder or dealer
1	96-in., 600-ton	Wheel press	Southwark Foundry & Machine Co.

Cincinnati Northern

No.	Size and capacity	Type of machine	Builder or dealer
1	21-in. by 10 ft.	Engine lathe	R. K. LeBlond Machine Tool Co.

Cleveland, Cincinnati, Chicago & St. Louis

No.	Size and capacity	Type of machine	Builder or dealer
2		Double head axle lathes	Niles-Bement-Pond Co.
1	20-in. by 10-ft.	Engine lathe	Cisco Machine Tool Co.
2	21-in. by 10-ft.	Engine lathes	R. K. LeBlond Machine Tool Co.
1	23-in. by 12-ft.	Engine lathe	R. K. LeBlond Machine Tool Co.
1	24-in. by 12-ft.	Engine lathe	Bradford Machine Tool Co.
1	24-in. by 12-ft.	Engine lathe	Lodge & Shipley Machine Tool Co.
1	2-in. by 24-in.	Flat turret lathe	Jones & Lamson Machine Co.
1	48-in.	Car wheel lathe	Niles-Bement-Pond Co.
1	42-in.	Car journal lathe	Niles-Bement-Pond Co.
2	5-ft.	Radial drills	Cincinnati-Bickford Tool Co.
2	5-ft.	Radial drills	Niles-Bement-Pond Co.
1	24-in. by 36-in.	Vertical drill press	Cincinnati-Bickford Tool Co.
1	24-in.	Vertical drill press	Aurora Tool Works
2	24-in. to 36 in.	Vertical drill presses	Cincinnati-Bickford Tool Co.
1	36-in.	Vertical drill press	Cincinnati-Bickford Tool Co.

Cleveland, Cincinnati, Chicago & St. Louis (Continued)

No.	Size and capacity	Type of machine	Builder or dealer
2	48-in.	Car wheel boring mills	Niles-Bement-Pond Co.
1	36-in. by 36-in. by 16-ft.	Planer type miller	Newton Mach. Tool Works
1	32-in.	Crank shaper	Cincinnati Shaper Co.
1	32-in.	Crank shaper	Gould & Eberhardt
1		Link grinder	Gisholt Mach. Co.
1	24-in. by 4-in.	Double end dry emery grinder	U. S. Electrical Tool Co.
5	18-in. by 3-in.	Double end dry floor grinders	U. S. Electrical Tool Co.
1		Cylinder head facing machine	H. B. Underwood Corp.
5	2-in.	Double head bolt cutters	Acme Machine Co.
1	3-in.	Single head bolt cutter	Landis Tool Co.
1	2½-in. to 12-in.	Pipe threading machine	Bignall & Keller Mfg. Wks.
1	⅛-in. to 4-in.	Pipe threading machine	Bignall & Keller Mfg. Wks.
1	750-ton	Four post hydraulic press	Southwark Foundry & Mach. Co.
1	600-ton, 48-in.	Car wheel press	Chambersburg Engineering Co.
1		Thoatless rotary shear	Marshalltown Mfg. Co.
1	16-gage, 18-in.	Square shear	Peck, Stow & Wilcox Co.
1	⅜-in. by 8-ft.	Power gap shear	Bertsch & Co.
1	36-in.	Automatic cut-off saw	J. A. Fay & Egan Co.
1	42-in.	Band saw	American Woodworking Mach. Co.
1	16-in.	Swing cut-off saw	American Woodworking Mach. Co.

Delaware & Hudson

No.	Size and capacity	Type of machine	Builder or dealer
1	20-in by 10-ft.	Engine lathe	American Tool Works Co.
1	28-in	Drill press	Barnes Machine Tool Co.
1	32-in.	Back gear shaper	Cincinnati Shaper Co.
1	16-in. by 2½-in. by 1½-in.	Double end grinder	Blount Machine Tool Co.

Delaware, Lackawanna & Western

No.	Size and capacity	Type of machine	Builder or dealer
1	6-in. by 11-ft.	Putnam double axle lathe	Manning, Maxwell & Moore
2	6-in. by 11-ft.	Journal and axle lathes	Niles-Bement-Pond Co.
1	42-in.	Vertical turret lathe	Bullard Machine Tool Co.
2	24-in.	Vertical drills	Defiance Machine Works
2	48-in.	Car wheel borers	Niles-Bement-Pond Co.
1	30-in.	Combination punch and shear	Henry Pels & Co.
1	⅛-in. to 2-in.	Pipe threading machine	Oster Manufacturing Co.
1	800-ton	Driving wheel press	Chambersburg Engineering Co.
1	3,400-lb.	Steam hammer	Chambersburg Engineering Co.

Denver & Intermountain

No.	Size and capacity	Type of machine	Bulider or dealer
1	16-in.	Circular wood saw	J. A. Fay & Egan Co.

Denver & Rio Grande Western

No.	Size and capacity	Type of machine	Builder or dealer
1	8-in. by 18-in.	Power hack saw	Robertson Machine & Foundry Co.
1	½-in. to 2-in.	Pipe cutter	Geist Manufacturing Co.
1	½-in. to 2-in.	Pipe threading machine	Landis Machine Co.
2	250-lb.	Power hammers	Moloch Co.
2		Alligator shears	Doelger & Kirsten
1	2-in.	Washer press	Southwark Foundry & Mach'y Co.
1	16-in.	Variety saw	Greenlee Bros. & Co.
1	36-in.	Patternmaker's speed lathe	Oliver Machinery Co.

Detroit, Toledo & Ironton

No.	Size and capacity	Type of machine	Builder or dealer
1		Car wheel grinding machine	Norton Co.

Duluth, Missabe & Northern

No.	Size and capacity	Type of machine	Builder or dealer
1	21-in.	Vertical drill	Richards Mach. Co.
2	10-in.	Double bench grinders	U. S. Electrical Tool Co.
1	36-in.	Shear	Niagara Machine & Tool Co.
1	1½-in.	Mortiser	J. A. Fay & Egan Co.
1	6E	Fox trimmer	J. A. Fay & Egan Co.
1		Belt sander	J. A. Fay & Egan Co.
1		Hair and moss picker	F. Franke & Co.

Great Northern

No.	Size and capacity	Type of machine	Builder or dealer
1	18-in. by 10-ft.	Engine lathe	Lodge & Shipley Mach. Tool Co.
1	3¼-in. by 28-in.	Flat turret lathe	Cincinnati Acme Tool Co.
1		Driving box boring mill	Bullard Machine Tool Co.
1		Car wheel boring mill	Wm. Sellers & Co.
1	600-ton	Driving wheel press	Watson-Stillman Co.

Gulf Coast Lines

No.	Size and capacity	Type of machine	Builder or dealer
1	32-in.	Heavy duty shaper	Columbia Mach. & Tool Co.
1	50-ton	Forcing and bending press	Chambersburg Engineering Co.

Gulf Mobile & Northern

No.	Size and capacity	Type of machine	Builder or dealer
1	36-in. by 36-in. by 10-ft.	Planer	Niles-Bement-Pond Co.

Hocking Valley

No.	Size and capacity	Type of machine	Builder or dealer
1	42-in.	Vertical turret lathe	Bullard Machine Tool Co.
1	22-in.	Sliding head vertical drill press	Aurora Tool Works
1	8-spindle	Valve grinder	Automatic Valve Grind. Mach. Co.
1	2-in.	Bolt threading machine	Landis Mach. Co
1	100-ton	Hydraulic forcing press	Hydraulic Press Mfg. Co.
1	36-in. by 18-ft.	Medium pattern lathe	American Tool Works Co.

Illinois Central

No.	Size and capacity	Type of machine	Builder or dealer
1	90-in.	Journal lathe	Niles-Bement-Pond Co.
1		Semi-auto valve finishing machine	Walter H. Foster Co.

Kansas City Southern

No.	Size and capacity.	Type of machine	Builder or dealer
1		Journal and axle lathe	Niles-Bement-Pond Co.
1	16-in. by 8-ft.	Portable engine lathe	American Tool Works Co.
1	18-in. by 10-ft.	Engine lathe	Lodge & Shipley Mach. Tool Co.
1	24-in. by 8-ft.	Engine lathe	Boye & Emmes Mach. Tool Co.
2	27-in. by 16-ft.	Engine lathes	Lodge & Shipley Mach. Tool Co.
1		Turret lathe	Warner & Swasey
1		Hexagon turret lathe	Warner & Swasey
1	54½-in.	Vertical turret lathe	Bullard Mach. Tool Co.
1	54-in.	Tire turning lathe	Manning, Maxwell & Moore
1	5-ft.	Plain radial drill	American Tool Works Co.
1	6-ft.	Radial drill	Dreses Mach. Tool Co.
1	6-ft.	Universal radial drill	Dreses Mach. Tool Co.
1		Heavy duty upright drill	Baker Brothers, Inc.
1	42-in. by 42-in. by 16-ft.	Planer	G. A. Gray Co.
1	28-in.	Shaper	Columbia Mach. Tool Co.
1	32-in.	Shaper	Columbia Mach. Tool Co.
1	48-in.	Car wheel boring machine	Manning, Maxwell & Moore
1		Horizontal boring and mill. mach.	Giddings & Lewis Mach. Tool Co.
1		Milling machine	Cincinnati Milling Mach. Co.
1		Internal grinding machine	Heald Mach. Co.
1	30-in.	Guide grinder	Diamond Mach. Co.
2		Floor grinders	Hisey-Wolf Mach. Co.
6		Bench grinders	Hisey-Wolf Mach. Co.
2		Pipe threading machines	Landis Mach. Co.
1		Triple head bolt threader	Landis Mach. Co.
1	400-ton, 48-in.	Wheel press	Niles-Bement-Pond Co.
2	100-ton	Hydraulic bushing presses	Chambersburg Engineering Co.
1	1,500-lb.	Single frame steam hammer	Chambersburg Engineering Co.
1	5,000-lb.	Single frame steam hammer	Chambersburg Engineering Co.
1	3-in.	Forging machine	National Machy. Co.
1	2-in. by 5-in.	Guillotine type bar shears	Long & Allstatter Co.
1		Flue swedging machine	Draper Mfg. Co.
1		Flanging machine	McCabe Mfg. Co.
1	30-in.	Double end patternmaker's lathe	Oliver Mach. Co.
1		Pattermaker's hand carving mach.	

Lake Superior & Ishpeming

No.	Size and capacity	Type of machine	Builder or dealer
1		Grinding machine	Western Stores Co.

No.	Size and capacity	Type of machine	Builder or dealer
1	.....	Hair and moss picker	F. Franke & Co.

No.	Size and capacity	Type of machine	Builder or dealer
1	.....	Grinding machine	Western Stores Co.

Duluth, South Shore & Atlantic

No.	Size and capacity	Type of machine	Builder or dealer
2	.....	Engine lathes	Lodge & Shipley Mach. Tool Co.
1	28-in.	Drill press	Cincinnati-Bickford Tool Co.
1	No. 2.	Milling machine	Cincinnati Milling Mach. Co.

East Broad Top

No.	Size and capacity	Type of machine	Builder or dealer
1	8-in. by 8-in.	Metal cutting machine	Racine Tool & Machine Co.

Elgin, Joliet & Eastern

No.	Size and capacity	Type of machine	Builder or dealer
1	No. 2	Eye-bolt machine	Williams, White & Co.

Erie

No.	Size and capacity	Type of machine	Builder or dealer
1	.....	Center drive axle lathe	Niles-Bement-Pond Co.
2	16-in. by 8-ft.	Engine lathes	Davis Machine Tool Co.
1	Type B-6	Bench lathe	Dalton Co.
1	33-in.	Drill press	J. E. Snyder Co.
2	¾-in.	Sensitive drill presses	Sipp Mach. Tool Co.
1	20-in.	Shaper	Gould & Eberhardt
2	24-in.	Shapers	Gould & Eberhardt
1	48-in.	Car wheel borer	Niles-Bement-Pond Co.
2	3½-in. by 7-ft.	Valve chamber boring bars	H. B. Underwood Corp.
1	.....	Universal miller	Cincinnati Milling Mach. Co.
1	.....	Milling machine	Cincinnati Milling Mach. Co.
2	2¼-in.	Twist drill grinders	Oliver Mach. Co.
1	.....	Band saw filer and setter	Black Diamond Saw & Mach. Wks.
1	18-in.	Swing frame grinding machine	Excelsior Tool & Mach. Co.
1	1¼-in.	Double head bolt threader	Landis Machine Co.
1	½-in. to 4-in. No. 304 B	Pipe threading machine	Oster Mfg. Co.
1	No. 15	Arbor press	Greenerd Co.
1	100-ton	Bushing press	Chambersburg Engineering Co.
1	500-lb.	Motor driven blacksmith hammer	Blacker Engineering Co.
1	No. 45	Slitting shear	Niagara Mach. & Tool Wks.
1	42-in.	Squaring shear	Peck Stow & Wilcox Co.
1	1-in. to 2½-in.	Electric flue welding machine	Thomson Elec. Weld. Co.
1	8-in. by 10-in.	Compression riveter	Allen & Co.
1	¼-in. to ¾-in.	Hollow chisel mortiser	Greenlee Bros. & Co.
1	24-in.	Hand jointer and planer	J. A. Fay & Egan Co.
1	4-in. by 7½-in.	Tenoning machine	Greenlee Bros. & Co.
1	20-in.	Variety saw	Greenlee Bros. & Co.
1	42-in.	Band saw	J. A. Fay & Egan Co.

Florida East Coast

No.	Size and capacity	Type of machine	Builder or dealer
1	21-in. by 10-ft.	LeBlond engine lathe	Niles-Bement-Pond Co.
1	27-in. by 14-ft.	LeBlond engine lathe	Niles-Bement-Pond Co.
1	28-in.	Turret lathe	Gisholt Machine Co.
1	36-in.	Vertical turret lathe	Bullard Mach. Tool Co.
1	3-in. by 36-in.	Flat turret lathe	Jones & Lamson Mach. Co.
1	32-in.	Crank planer	Consolidated Mach. Tool Co.
4	26-in.	Stockbridge crank shapers	Niles-Bement-Pond Co.
1	.....	Grand Rapids drill grinder	Niles-Bement-Pond Co.
3	2-in.	Triple head threading machines	Landis Mach. Co.
1	4-in.	Pipe threader and cutter	Landis Mach. Co.
1	32-in.	Aurora drill press	Niles-Bement-Pond Co.
1	100-ton	Forcing and bending press	Watson-Stillman Co.

Fort Worth & Denver City

No.	Size and capacity	Type of machine	Builder or dealer
1	3-in. by 36-in	Flat turret lathe	Jones & Lamson Mach. Co.
1	28-in.	Drill press	Barnes Drill Co.
2	No. 121	Dry grinders	Ransom Mfg. Co.
1	No. 585	Oilstone tool grinder	Oliver Machinery Co.
1	36-in., No. 10	Band saw	American Wood Working Mach. Co.
1	38-in.	Band and resaw mach	American Wood Working Mach. Co.

Georgia, Florida & Alabama

No.	Size and capacity	Type of machine	Builder or dealer
1	No. 515	Universal wood worker	J. A. Fay & Egan Co.

Lehigh & New England

No.	Size and capacity	Type of machine	Builder or dealer
1	16-in. by 6-ft.	Engine lathe	Lodge & Shipley Mach. Tool Co.
1	20-in. by 10-ft.	Engine lathe	Lodge & Shipley Mach. Tool Co.
1	.....	Turret lathe	Warner & Swasey Co.
1	28-in.	Vertical drill	Superior Machine Tool Co.
1	36-in. by 36-in. by 10-ft.	Gray planer	Swind Machinery Co.
1	28-in.	Heavy duty shaper	Ohio Machine Tool Co.

Lehigh Valley

No.	Size and capacity	Type of machine	Builder or dealer
1	.....	Combination journal axle lathe	Niles-Bement-Pond Co.
1	90-in.	Journal turning lathe	Manning, Maxwell & Moore
2	18-in. by 10-ft.	Screw cutting engine lathe	Manning, Maxwell & Moore
2	20-in. by 12-ft.	Screw cutting engine lathe	Manning, Maxwell & Moore
1	23-in. by 12-ft.	LeBlond engine lathe	Niles-Bement-Pond Co.
1	42-in. by 16-ft.	Screw cutting engine lathe	Manning, Maxwell & Moore
1	90-in.	Driving wheel lathe	Wm. Sellers & Co.
1	.....	Universal turret lathe	Foster Machine Co.
1	3½-in. by 40-in.	Flat turret lathe	Manning, Maxwell & Moore
1	54-in.	Vertical turret lathe	Bullard Machine Tool Co.
1	42-in.	Vertical turret lathe	Bullard Machine Tool Co.
1	6-ft.	Radial drill	Niles-Bement-Pond Co.
4	5-ft.	Dreses radial drills	Manning, Maxwell & Moore
3	32-in.	Crank planers	Consolidated Machine Tool Co.
3	38-in.	Crank planers	Consolidated Machine Tool Co.
4	24-in.	Stockbridge crank shaper	Niles-Bement-Pond Co.
1	36-in.	Draw cut shaper	Morton Manufacturing Co.
1	48-in.	Car wheel boring mill	Wm. Sellers & Co.
1	.....	Journal boring machine	Ar-An-Ess Mfg. Co.
1	.....	Drill grinder	Oliver Instrument Co.
1	3½-in.	Flue and pipe bending machine	Baird Pneumatic Tool Co.
1	¾-in.	Plate flanging machine	McCabe Manufacturing Co.
1	.....	Adjusting machine	Walter Stock Adjusting Mach. Co.
1	.....	Thomson flue welder	Sherritt & Storer Co.
1	14-gage	Cornice brake	Peck, Stow & Wilcox Co.

Long Island

No.	Size and capacity	Type of machine	Builder or dealer
2	20-in. by 8-ft.	Engine lathes	Boye & Emmes Machine Tool Co.
3	23-in. by 12-ft. T3	Heavy duty engine lathes	R. K. LeBlond Machine Tool Co.
1	5-ft.	Radial drill	American Tool Works Co.
1	24-in. by 24-in. by 24-in.	Crank planer	Woodward & Powell Machine Co.
1	20-in.	High duty shaper	Gould & Eberhardt
1	2-in	Double head bolt cutter	Williams Tool Corp.
1	150-ton	Horizontal forcing press	Watson-Stillman Co.
1	.....	Blacksmith hammer	Blacker Engineering Co.
1	No. 6-E 18-in.	Squaring shear	Niagara Machine & Tool Wks.
1	No. 206	Power bending brake	Eres & Krump Manufacturing Co.

Los Angeles & Salt Lake

No.	Size and capacity	Type of machine	Builder or dealer
1	14-in. by 8-ft.	Tool room lathe	Manning, Maxwell & Moore
2	14-in. by 8-ft.	Monarch portable lathes	Herberts Machinery & Supply Co.
2	18-in. by 10-ft.	Monarch lathes	Herberts Machinery & Supply Co.
1	24-in. by 12-ft.	Monarch lathe	Herberts Machinery & Supply Co.
1	42-in. by 16-ft.	Betts-Bridgeford engine lathe	Herberts Machinery & Supply Co.
1	9¼-in.	Gisholt turret lathe	Herberts Machinery & Supply Co.
1	42-in.	Bullard vertical turret lathe	Harron, Rickard & McCone
1	.....	Universal turret lathe	Smith-Booth-Usher Co.
1	6-ft.	Radial drill	Herberts Machinery & Supply Co.
1	5-ft.	Radial drill	Herberts Machinery & Supply Co.
1	34-in.	Sliding head drill press	Manning, Maxwell & Moore
1	42-in.	Sliding head drill press	Manning, Maxwell & Moore
2	½-in.	Ireland Clifford drill presses	Herberts Machinery & Supply Co.
2	¾-in.	Sensitive drill presses	Manning, Maxwell & Moore
1	24-in. by 24-in.	Crank planer	Manning, Maxwell & Moore
1	36-in.	Draw-cut shaper	Morton Manufacturing Co.
1	32-in.	Cincinnati Climax shaper	Herberts Machinery & Supply Co.
1	8-ft.	Betts vertical boring mill	Herberts Machinery & Supply Co.
1	24-in.	Betts slotting machine	Herberts Machinery & Supply Co.
1	.....	Radius planing attachment	Herberts Machinery & Supply Co.
1	.....	Sundstrand radius grinder	Herberts Machinery & Supply Co.
1	15-in. by 15-in. by 8-in.	Norton surface grinder	Herberts Machinery & Supply Co.
8	5-hp.	Grinding machines, dry.	Herberts Machinery & Supply Co.
1	.....	Wilmarth & Morman tool grinder	Herberts Machinery & Supply Co.
2	.....	Racine metal cutting machines	Eccles & Davies

Los Angeles & Salt Lake (Continued)

No.	Size and capacity	Type of machine	Builder or dealer
1	6-in. by 10-ft.	Portable boring bar	Herberts Machinery & Supply Co.
1	1¼-in.	Landis bolt threading machine	Herberts Machinery & Supply Co.
1	2-in.	Landis bolt threading machine	Herberts Machinery & Supply Co.
2	36-in. by 72-in., 50-ton	Draw forcing presses	Louis G. Henes
1	50-ton	Hydraulic bushing press	Manning, Maxwell & Moore
1	2,000-lb.	Chambersburg steam hammer	Manning, Maxwell & Moore
1	100-lb.	Bradley helve hammer	Herberts Machinery & Supply Co.
1	4-in.	Centering machine	Manning, Maxwell & Moore
1	1½-in to 6½-in.	Flue welding machine	Jos. T. Ryerson & Son
1	4-spindle	Vertical car borer	Greenlee Bros. & Co.
1		Surface planing machine	J. A. Fay & Egan Co.
1		Hollow chisel car mortiser	Greenlee Bros. & Co.
1	44-in.	Automatic cut-off saw	Greenlee Bros. & Co.
1	36-in.	Self-feed rip saw	Greenlee Bros. & Co.

Louisville & Nashville

No.	Size and capacity	Type of machine	Builder or dealer
2	16-in. by 8-ft.	Engine lathes	R. K. LeBlond Machine Tool Co.
1	18-in. by 8-ft.	Engine lathe	R. K. LeBlond Machine Tool Co.
1	18-in. by 10-ft.	Engine lathe	Boye & Emmes Mach. Tool Co.
4	20-in by 10-ft.	Engine lathes	R. K. Leblond Machine Tool Co.
1	21-in. by 12-ft.	Engine lathe	R. K. Leblond Machine Tool Co.
1	36-in. by 18-ft.	Engine lathe	Betts-Bridgeford Co.
1	42-in. by 19-ft.	Engine lathe	American Tool Works
1	4-ft.	Radial drill press	American Tool Works
2	21-in.	Drill presses	Cincinnati Bickford Tool Co.
1	28-in.	Drill press	Cincinnati Bickford Tool Co.
1	36-in.	Drill press	Cincinnati Bickford Tool Co.
1	42-in.	Drill press	Cincinnati Bickford Tool Co.
1		Drill press	Barnes Drill Co.
1	36-in. by 8-ft.	Planer	Cincinnati Bickford Tool Co.
1	36-in. by 36-in. by 12-ft.	Planer	Niles-Bement-Pond Co.
1	36-in. by 18-ft.	Planer	Cincinnati Bickford Tool Co.
1	20-in.	Shaper	Gould & Eberhardt
3	32-in.	Shapers	Ohio Machine Tool Co.
1	18-in.	Slotter	Niles-Bement-Pond Co.
1	62-in.	Boring mill	Niles-Bement-Pond Co.
1	66-in.	Boring and drilling machine	Niles-Bement-Pond Co.
1	73-in.	Boring and turning mill	Niles-Bement-Pond Co.
1		Link grinder	Gisholt Machine Tool Co.
1		Floor grinder	U. S. Electrical Tool Co.
1		Dry grinder	U. S. Electrical Tool Co.
1		Cutter and reamer grinder	R. K. LeBlond Machine Tool Co.
1	8-spindle	Valve grinder	Automatic Valve Grind'g Mach Co.
1	36-in.	Band saw	American Tool Works
2	6-in. by 6-in.	Power hack saws	Acme Machine Tool Co.
1	2-in.	Bolt cutter	Acme Machine Tool Co.
1	1½-in.	Bolt threading machine	Landis Machine Co.
1	2-in.	Bolt threading machine	Landis Machine Co.
1	600-ton	Wheel press	Chambersburg Engineering Co.
1	100-ton	Bushing press	Southwark Foundry & Machine Co.
1	800-lb.	Steam hammer	Niles-Bement-Pond Co.
1	48-in.	Punch	Cleveland Punch & Shear Co.
1		Punch and shear	Niagara Machine & Tool Works
1	1½-in. to 6½-in.	Flue welding machine	J. T. Ryerson & Son

Maine Central

No.	Size and capacity	Type of machine	Builder or dealer
1	13-in. by 6-ft.	Portable engine	Niles-Bement-Pond Co.
2	17-in. by 8-ft.	Engine lathes	J. T. Ryerson & Son
1	22-in. by 46-in. by 10-ft.	Gap lathe	Niles-Bement-Pond Co.
1	25-in. by 12-ft.	Engine lathe	J. T. Ryerson & Son
1	5-ft.	Radial drill	J. T. Ryerson & Son
1	20-in. by 8-ft.	Piston rod grinder	Landis Tool Co.
1	20-in. by 36-in. by 96-in.	Link grinder	Gishclt Machine Co.
1		Horizontal metal band saw	Napier Saw Works
1	100-ton	Hydraulic forcing press	Chambersburg Engineering Co.
1	12-in.	Buzz planer	J. A. Fay & Egan Co.
1	36-in.	Band saw	J. A. Fay & Egan Co.

Maryland & Pennsylvania

No.	Size and capacity	Type of machine	Builder or dealer
1	3-in. by 36-in.	Flat turret lathe	Jones & Lamson Mach. Co.
1		Single end punch and shear	Cleveland Punch & Shear Co.
1		Bending roll	Cleveland Punch & Shear Co.
1	48-in.	Car wheel boring mill	Niles-Bement-Pond Co.
1	48-in.	Car wheel boring mill	Niles-Bement-Pond Co.
2		Universal milling machines	Cincinnati Milling Mach. Co.
1	54-in. by 30-in. by 16-ft.	Horizontal milling machine	Ingersoll Milling Mach. Co.
1	54-in.	Vertical milling machine	Ingersoll Milling Mach. Co.
2		Tool room milling machines	Brown & Sharpe Mfg. Co.
2		Internal grinder	Heald Machine Co.
1		Link radius grinders	H. G. Hammet
10		Double end emery grinder	Niles-Bement-Pond Co.
1		Universal double end emery grdr.	U. S. Elec. Tool Co.
2	1½-in.	Grinders	Cincinnati Milling Mach. Co.
3		Drill grinders	Wilmarth & Morman Co.
1		Universal grinder	Niles-Bement-Pond Co.
3		Oil stone tool grinders	Oliver Machinery Co.
2	26-in	Newton cold cut-off saws	Consolidated Machine Tool Corp.
1	32-in.	Newton cold cut-off saw	Consolidated Machine Tool Corp.
1		Hack saw	Atkins Co.
1	1½-in.	Double head bolt threader	National Mach. Co.
1	2-in.	Double head bolt threader	Landis Mach. Tool Co.
1	1½-in.	Double head bolt threader (belt)	National Mach. Co.
3	¼-in. to 2-in.	Double head pipe threader	Landis Mach. Tool Co.
1	¼-in. to 2-in.	Double head pipe threader	Oster Manufacturing Co.
4	1-in. to 4-in.	Double head pipe threaders	Oster Manufacturing Co.
2	48-in., 400-ton	Car wheel presses	Niles-Bement-Pond Co.
7	100-ton	Hydraulic bushing presses	Niles-Bement-Pond Co.
2		Power presses	Belt Slayman & Co.
1	5,000-lb.	Steam hammer	Chambersburg Engineering Co.
2		Triple gage punches	H. J. Pels & Co.
2		Power gap shears	Niagara Machine & Tool Wks.
4		Universal punch and shears	H. J. Pels Co.
1		Universal punch and shear	Buffalo Forge Co.
3	24½-in.	Double cylinder flue welders	J. T. Ryerson Co.
3	1½-in. to 3-in.	Auto. safe end cut-off machines	Jos. T. Ryerson & Son
3	2-in. to 6½-in.	Comb. hot saw and flue expanders	Jos. T. Ryerson & Son
2	¾-in.	Pneumatic flangers	McCabe Manufacturing Co.
2	6-in.	Bench hand planers	J. D. Wallace & Co.
3	7-in.	Universal bench saws	J. D. Wallace & Co.
2	18-in.	Bench band saws	J. D. Wallace & Co.
1	18-in.	Band saw	Oliver Machinery Co.
1	20-in.	Variety saw	J. A. Fay & Egan Co.
1	36-in.	Swing saw	Oliver Machinery Co.
1	36-in.	Band saw	J. A. Fay & Egan Co.
1	6-in.	Bench jointer	J. D. Wallace Co.

Nashville, Chattanooga & St. Louis

No.	Size and capacity	Type of machine	Builder or dealer
1	18-in. by 8-ft.	Engine lathe	Boye & Emmes Mach. Tool Co.
1	34-in.	Sliding head upright drill press	Barnes Drill Co.
1	28-in.	Crank shaper	Columbia Mach. Tool Co.
2	18-in. by 3-in.	Double end emery wheel grinders	Hisey-Wolf Mach. Co.
2		Drill grinders	Wilmarth & Morman Co.
1		Single end punch and shear	Hilles & Jones Co.
1	¾-in.	Pneumatic flanging machine	McCabe Manufacturing Co.

National Railways of Mexico

No.	Size and capacity	Type of machine	Builder or dealer
1	17-in. by 10-ft.	Engine lathe	Jos. T. Ryerson & Son
2	90-in.	Driving wheel lathes	Jos. T. Ryerson & Son
6		Universal hexagon turret lathes	Jos. T. Ryerson & Son
6		Geared head turret lathes	Jos. T. Ryerson & Son
6		Universal hexagon turret lathes	Jos. T. Ryerson & Son
3	20-in.	Rockwell drill presses	Jos. T. Ryerson & Son
1	18-in.	Portable valve seat planer	Jos. T. Ryerson & Son
1	28-in.	Portable valve seat planer	Jos. T. Ryerson & Son
2		Morton cylinder planers	Jos. T. Ryerson & Son
1	30-in.	Crank slotting machine	Jos. T. Ryerson & Son
1	42-in.	Colburn vertical boring mill	Jos. T. Ryerson & Son
2	48-in.	Light car wheel borers	Jos. T. Ryerson & Son
6		Pedestal milling machines	Jos. T. Ryerson & Son
1		Cold saw cutting off machine	Jos. T. Ryerson & Son
1	No. 1	Cylinder or dome facing machine	Jos. T. Ryerson & Son
2	No. 2	Cylinder or dome facing machines	Jos. T. Ryerson & Son
3	No. 2	Portable crank pin turn'g machines	Jos. T. Ryerson & Son
1	No. 3	Cylinder or dome facing machine	Jos. T. Ryerson & Son
2		Forbes hand threading machines	Jos. T. Ryerson & Son
1	400-ton	Vertical wheel press	Jos. T. Ryerson & Son
3	50-ton	Vertical bushing presses	Jos. T. Ryerson & Son
3	2,000-lb.	Erie forging hammers	Jos. T. Ryerson & Son
2	40-in.	Square and circular shears	Jos. T. Ryerson & Son
2		Combined punches and shears	Jos. T. Ryerson & Son

No.	Size and capacity	Type of machine	Builder or dealer
1	3-in. by 36-in.	Flat turret lathe	Jones & Lamson Mach. Co.
1		Single end punch and shear	Cleveland Punch & Shear Co.
1		Bending roll	Cleveland Punch & Shear Co.
2		Bar folders	Jos. T. Ryerson & Son
2		Slip roll formers	Jos. T. Ryerson & Son
2	37-in.	Vertical boring machines	Jos. T. Ryerson & Son
2	Three-spindle	Hollow chisel mortisers	Jos. T. Ryerson & Son
2		Double cylinder surface planers	Jos. T. Ryerson & Son
2		Vertical car tenoning machines	Jos. T. Ryerson & Son
2		Rip saw	Jos. T. Ryerson & Son
1		Band sawing machines	Jos. T. Ryerson & Son
2		Crimping and beading machines	Jos. T. Ryerson & Son
2		Beading machines	Jos. T. Ryerson & Son
2		Burring machines	Jos. T. Ryerson & Son
4		Continuous feed glue jointers	Jos. T. Ryerson & Son
2		Right hand edgers	Jos. T. Ryerson & Son
2		Setting down machines	Jos. T. Ryerson & Son
2		Turning machines	Jos. T. Ryerson & Son
2	40-in.	Square and circular shears	Jos. T. Ryerson & Son
2		Combined punches and shears	Jos. T. Ryerson & Son

Michigan Central

No.	Size and capacity	Type of machine	Builder or dealer
1	24-in. by 14-ft.	Engine lathe	Lodge & Shipley Mach. Tool Co.
1	16-in.	Portable lathe	
1	30-in.	Turret lathe	Steinle Turret Mach. Co.
2	36-in.	Drill presses	Superior Mach. Tool Co.
1	3-spindle	Drill	Superior Mach. Tool Co.
1	36-in. by 36-in. by 12-ft.	Planer	Liberty Mach. Tool Co.
2	30-in.	Shapers	Ohio Machine Tool Co.
1	3-in. by 16-in.	Floor grinder	Fordsmith Machine Co.
1	3-in. by 18-in.	Grinder	Ransom Mfg. Co.
1		Drill grinder	Oliver Machy. Co.
1		Double end grinder	Ransom Mfg. Co.
1		Cylinder boring bar	H. B. Underwood Corp.
1		Pipe threader	Oster Manufacturing Co.
1	4-in.	Bolt threader	Landis Machine Co.
1	1½-in.	Single end wheel press	Chambersburg Engineering Co.
1	400-ton	Bushing presses	Southwark Foundry & Mach. Co.
3	100-ton	Hydraulic bending press	Tinius Olsen Testing Mach. Co.
1	5-in. by 7-ft, 6-in.	Portable pipe bending mach.	H. B. Underwood Corp.
1	¾-in. by 2½-in.	McCabe Flanger	McCabe Manufacturing Co.
1		Punch	Buffalo Forge Co.
1	1½-in.	Bar shear	Buffalo Forge Co.
1	1-in. by 4-in.	Peerless squaring shear	Kutcheid Manufacturing Co.
1	18-in. by 36-in.	Lennox throatless shear	Marshalltown Manufacturing Co.
1	22-gage	Flue polisher	Production Machine Co.
1		Flue welder	Thomson Electric Welder Co.
1	¼-in. by 8-ft. 1-in.	Chicago steel bending brake	Dries & Krump
1	36-in.	Heavy rip saw	Greenlee Bros. Co.
1		Wood milling machine	Oliver Machy. Co.
1	4-in.	Wood shaper	P. B. Yates Mach. & Tool Co.

Minneapolis, St. Paul & Sault Ste. Marie

No.	Size and capacity	Type of machine	Builder or dealer
3	18-in. by 8-ft.	Engine lathes	Lodge & Shipley Mach. Tool Co.
2	12-in. by 1¼-in.	Tool grinders	U. S. Electrical Tool Co.

Missouri-Illinois

No.	Size and capacity	Type of machine	Builder or dealer
1		Mahrvel power hack saw	Crerar Adams & Co.
1	100-ton	Hydraulic press	Lourie Hydraulic Mfg. Co.

Missouri-Kansas-Texas

No.	Size and capacity	Type of machine	Builder or dealer
1	36-in.	Aurora drill press	Niles-Bement-Pond Co.
1	26-in.	Crank shaper	Niles-Bement-Pond Co.
1		Oster pipe machine	Manning, Maxwell & Moore
1	2-in. by 30-in	Stove and tin pipe former	Manning, Maxwell & Moore
1	36-in.	Keystone bar folder	Manning, Maxwell & Moore

Missouri Pacific

No.	Size and capacity	Type of machine	Builder or dealer
2	14-in. by 4-ft.	Engine lathes	Niles-Bement-Pond Co.
1	16-in. by 8-ft.	Engine lathe	Lehman Machine Co.
1	18-in. by 9-ft.	Engine lathe	Lehman Machine Co.
1	20-in. by 8-ft.	Engine lathe	American Tool Works
1	20-in. by 10-ft.	Engine lathe	American Tool Works
1	20-in by 10-ft.	Heavy duty engine lathes	Lehman Machine Co.
2	24-in. by 5-ft.	Geared head engine lathes	American Tool Works
2	25-in. by 14-ft.	Heavy duty engine lathe	R. K. Le Blond Mach. Tool Co.
1	32-in. by 10-ft.	Vertical turret lathes	American Tool Works
4	36-in.	Vertical turret lathes	Bullard Machine Tool Co.
2	42-in.	Flat turret lathes	Bullard Machine Tool Co.
2	3-in. by 36-in.	Flat turret lathes	Jones & Lamson Mach. Co.
2	3¼-in. by 24-in.	Turret lathe	Jones & Lamson Mach. Co.
1		Heavy duty radial drills	Warner & Swasey Co.
6	3-ft.	Heavy duty radial drills	American Tool Works
2	4-ft.	Heavy duty radial drills	American Tool Works
2	6-ft.	Heavy duty radial drill	American Tool Works
1	6-ft.	Sensitive drill	Reed-Prentice Co.
1	One-spindle	Sensitive drill	C. G. Allen Co.
1	Two-spindle	Crank planers	C. G. Allen Co.
2	24-in. by 24-in. by 24-in.	Crank shapers	Woodward & Powell Planer Co.
2	32-in.	Slotter	Gould & Eberhardt
1	18-in.	Slotter	T. C. Dill Mach. Co.
1	24-in.	Horizontal boring mills	T. C. Dill Mach. Co.
2		Vertical boring mill	Lucas Machine Tool Co.
1	44-in.		Niles-Bement-Pond Co.

Nevada Northern

No.	Size and capacity	Type of machine	Builder or dealer
1	28-in.	Shaper	American Tool Works Co.

New York Central

No.	Size and capacity	Type of machine	Builder or dealer
2	16-in. by 4-ft.	Engine lathes	Niles-Bement-Pond Co.
2	16-in. by 8-ft.	Engine lathes	Manning, Maxwell & Moore
7	18-in. by 10-ft.	Engine lathes	Boye & Emmes Machine Tool Co.
1	20-in. by 8-ft.	Engine lathe	Boye & Emmes Machine Tool Co.
4	24-in. by 10-ft.	Engine lathes	Boye & Emmes Machine Tool Co.
1	24-in. by 10-ft.	Engine lathe	Cincinnati Lathe & Tool Co.
2	24-in. by 12-ft.	Engine lathes	Boye & Emmes Machine Tool Co.
1	30-in. by 7-ft.	Engine lathe	Manning, Maxwell & Moore
1	18-in.	Turret lathe	International Mach. Tool Co.
3	20-in.	Turret lathes	Manning, Maxwell & Moore
1	24-in.	Flat turret lathe	Bullard Machine Tool Co.
1	24-in.	Turret lathe	Manning, Maxwell & Moore
1	24-in.	Flat turret lathe	Manning, Maxwell & Moore
1	24-in.	Lathe	Manning, Maxwell & Moore
1	16-in.	Lathes	Niles-Bement-Pond Co.
2	17-in.	Lathe	Niles-Bement-Pond Co.
1	24-in.	Lathe	Niles-Bement-Pond Co.
1	25-in.	Lathe	Niles-Bement-Pond Co.
1	26-in.	Lathe	Niles-Bement-Pond Co.
1	90-in.	Radial drill	Cincinnati-Bickford Tool Co.
1	3-ft.	Radial drills	Niles-Bement-Pond Co.
3	4-ft.	Radial drill	Manning, Maxwell & Moore
1	4-ft.	Radial drill	American Tool Works Co.
1	5-ft.	Radial drills	Niles-Bement-Pond Co.
2	6-ft.	Drill press	Manning, Maxwell & Moore
1	16-in.	Vertical drill press	Niles-Bement-Pond Co.
1	26-in.	Sensitive drill press	Van Dyck Churchill Co.
1	20-in.	Planer	Niles-Bement-Pond Co.
1	30-in. by 120-in.	Planer	Niles-Bement-Pond Co.
1	48-in.	Planer	Niles-Bement-Pond Co.
1	60-in.	Shaper	Manning, Maxwell & Moore
1	32-in.	Shaper	Swing Mach. Co.
1	32-in.	Slotter	Wm. Sellers & Co.
1	20-in.	Rapid slotter	Jones Mach. Tool Works
1	25-in.	Vertical borer	Niles-Bement-Pond Co.
1	42-in.	Plain milling machine	Cincinnati Milling Mach. Co.
1	No. 5	Milling machine	Ingersoll Milling Machine Co.
1	30-in by 36-in. by 12-ft.	Cotter and Key seat drill	Niles-Bement-Pond Co.
1		Rotary milling machine	Ingersoll Milling Machine Co.
1	54-in.	Milling machine	Henry Prentice & Co.
1		Guide grinder	Manning, Maxwell & Moore
1	30-in.	Link grinder	Manning, Maxwell & Moore
1	16-in. by 48-in.	Grinder	Motch & Merryweather Mchy. Co.
1	12-in. by 36-in.	Plain grinder	Niles-Bement-Pond Co.
1	16-in. by 72-in.	Double emery grinders	Jos. T. Ryerson & Son
3	24-in. by 4-in.	Drill Grinders	Wm. Sellers & Co.
2	⅛-in. to 3-in.	Drill grinder	Wilmarth & Morman Co.
1		Die sharpener	Manning, Maxwell & Moore
1	6-in. wheel	Hack saw	Peerless Machine Co.
1	6⅝-in. by 6⅝-in.	Double head bolt cutter	Landis Machine Co.
1	⅜-in. to 2-in.	Double head bolt cutter	Landis Machine Co.
1	¼-in. to 2-in.	Triple head bolt cutter	Landis Machine Co.
1	⅜-in. to 2-in.	Triple head bolt threader	Landis Machine Co.
1	1½-in.	Triple head bolt cutter	Landis Machine Co.
1	2-in.	Bolt threaders	Landis Machine Co.
2	⅜-in. to 2-in.	Pipe threader	Motch & Merryweather Mchy. Co.
1	¼-in. to 4-in.	Pipe threader	Motch & Merryweather Mchy. Co.
1	1½-in to 4-in.	Pipe threader	Motch & Merryweather Mchy, Co.
1	2½-in. to 8-in.	Pipe threader	Manning, Maxwell & Moore
1			

New York Central (Continued)

No.	Size and capacity	Type of machine	Builder or dealer
1	4-in.	Pipe threading and cutting mach.	Landis Machine Co.
2	50-ton	Bushing presses	Manning, Maxwell & Moore
1	50-ton	Bushing press	Hydraulic Press Mfg. Co.
3	100-ton	Bushing presses	Manning, Maxwell & Moore
1	300-ton	Crank pin press	Watson-Stillman Co.
1	500-lb.	Steam hammer	Manning, Maxwell & Moore
1	100-ton	Bulldozer	Manning, Maxwell & Moore
1	1½-in.	Forging machine	Cleveland Equipment & Engrg. Co.
1	1½-in.	Forging machine	Ajax Manufacturing Co.
2		Adjusting machines	Walter Stock Adjusting Mach. Co.
1	12-in.	Bar shear	Cleveland Punch & Shear Wks.
1		Niagara shear	Vandycke Churchill Co.
1	48-in. throat	Punch and shear	Cleveland Punch & Shear Wks.
1		Punch and shear	Long & Allstatter Co.
1	2½-in.	Flue welder	Thomson Electric Welding Co.
1	¾-in. plate	Pneumatic flanger	McCabe Mfg. Co.
1		Vertical disk and spindle sander	Oliver Manufacturing Co.

New York, Chicago & St. Louis

No.	Size and capacity	Type of machine	Builder or dealer
1	18-in.	Libby turret lathe	International Mach. Tool Co.
1	21-in.	Engine lathe	R. K. LeBlond Mach. Tool Co.
1	30-in.	Engine lathe	American Tool Works Co.
1	3-in. by 18-in.	Grinder	Hisey-Wolf Mach. Co.
1	54-in.	Vertical boring mill	Bullard Mach. Tool Co.
1	4½-in. by 8 -ft.	Cylinder boring bar	H. B. Underwood Corp.
1	1½-in., 3-head	Staybolt cutter	Landis Mach. Co.
1	1¼-in.	Horizontal flange punch	Cleveland Punch & Shear Co.
1	¾-in.	Pneumatic flanging machine	McCabe Mfg. Co.

New York, New Haven & Hartford

No.	Size and capacity	Type of machine	Builder or dealer
1	2-in.	Die grinder	Acme Machinery Co.
1	6-in. by 6-in.	High speed metal cutting saw	Peerless Mach. Co.
2		Cylinder facing machines	H. B. Underwood Corp
2		Crank pin turning machines	E. J. Rooksby & Co.
1		Quintuple punch and shear	J. T. Ryerson & Son
4	3-in. by 12-in.	Tie and timber droppers	J. E. Tochey

New York, Ontario & Western

No.	Size and capacity	Type of machine	Builder or dealer
1	1½-in. to 6½-in.	Universal flue cleaning machine	J. T. Ryerson & Son

Northern Pacific

1			
1	2½-in. by 24-in.	Journal truing lathe	W. F. Dunn Co.
1	1¼-in to 3-in.	Flat turret lathe	Jones & Lamson Machine Co.
1		Die grinder	Murchy Machine & Tool Co.
1	4-in. by 6-ft.	Wet and dry grinder	Cleveland Arm. Wks.
2		Portable boring bar	H. B. Underwood Corp.
1		Portable crank pin turners	H. B. Underwood Corp.
1	2-in.	Pipe cutter	Murchy Machine & Tool Co.
1	½-in. to 6-in.	Double head pipe threading mach.	Landis Tool Co.
2	No. 111	Tube cutting machine	Jos. T. Ryerson & Son
1	⅞-in. by 16-ft.	Flue welders	Johnston Manufacturing Co.
1	24-ft.	Plate bending rolls	Consolidated Mach. Tool Co.
		Lumber trimmer with motor	American Saw Mill Co.

Norfolk & Southern

No.	Size and capacity	Type of machine	Builder or dealer
1	12-in. by 28-in.	Cylinder boring bar	H. B. Underwood Corp.

Norfolk & Western

3	14-ft.		
1		Car axle lathes	Niles-Bement-Pond Co.
2	16-in. by 8-ft.	Journal and axle lathe	Niles-Bement-Pond Co.
2	20-in. by 10-ft	Engine lathes	Bradford Machine Tool Co.
2	21-in. by 10-ft.	Engine lathes	Cisco Machine Tool Co.
2	27-in. by 16-ft.	Engine lathes	R. K. LeBlond Mach. Tool Co.
1	36-in. by 16-ft.	Engine lathe	Pittsburgh Mach. Tool Co.
1	52-in. by 24-ft.	Engine lathe	American Tool Works Co.
1	90-in.	Driving wheel lathe	Pittsburgh Mach. Tool Co.
1	28-in. to 42-in.	Car wheel lathe	Niles-Bement-Pond Co.
1	24-in.	Vertical turret lathe	Wm. Sellers & Co.
1	30-in.	Horizontal turret lathe	Bullard Machine Tool Co.
1	54-in.	Vertical turrent lathe	Steinle Turret Mach. Co.
			Bullard Mach. Tool Co.

No.	Size and capacity	Type of machine	Builder or dealer
1			
1		Automatic machine	
1		Car wheel lathe	
2		Lathe	
2		Radial drills	
1		Vertical drill presses	
2		Planer	
1		Crank planers	
2		Shaper	
6		Horizontal boring machines	
2		Cylinder boring mills	
1		Universal milling machines	
3		Vertical milling machine	
3		Rod grinding machines	
1		Double end emery grinders	
6		Double end floor grinder	
2		Lapping machines	
1		Cylinder facing machines	
1		Bolt altering machine	
1		Bar turning machine	
2		Staybolt machine	
6		Pipe threading machines	
1		Wheel presses	
1		Straightening press	
1		Bolt straightening hammer	
1		Shear	
1		Stock adjusting machine	
		Single cylinder surfacer	

Pittsburgh & Lake Erie

No.	Size and capacity	Type of machine	Builder or dealer
1	24-in. by 14-ft.	Engine lathe	Hendey Mach. Co.
1	16-in. by 8-ft.	Engine lathe	Springfield Mach. Tool Co.
1	2½-in. by 24-in.	Turret lathe	Jones & Lamson Mach. Co.
1	3½-in.	Turret lathe	Warner & Swasey Co.
1	3-ft.	Radial drill	American Tool Works
1	⅛-in. by ½-in.	Sensitive drill	Sipp Mach. Co.
1	¼-in. to 5⅛-in.	Bolt centering machine	
1	2-in. by 15-in.	Motor grinder	Heald Mach. Co.
1	¾-in.	Cold flanging press	McCabe Mfg. Co.

Quebec Central

No.	Size and capacity	Type of machine	Builder or dealer
1	4-ft., 6-in.	Radial drill	

Richmond, Fredericksburg & Potomac

No.	Size and capacity	Type of machine	Builder or dealer
1	36-in.	Engine lathe	American Tool Works Co.
1	36-in.	Engine lathe	Lodge & Shipley Mach. Tool Co.
1	4-ft.	Dreses radial drill	Manning, Maxwell & Moore
1	42-in.	Boring drill	Bullard Mach. Tool Co.
1	18-in. to 100-in.	Sundstand link grinder	Manning, Maxwell & Moore
1	4-in.	Pipe cutter and threader	Oster Manufacturing Co.
1	6-in.	Pipe cutter and threader	Oster Manufacturing Co.
1	24-in.	Punch and shear	J. T. Ryerson & Son
1		Bending roll	Segferts Sons

St. Louis-San Francisco

No.	Size and capacity	Type of machine	Builder or dealer
1			
1	400-ton	Double head axle lathe	
1	2,000-lb.	Wheel press	
		Steam hammer	

St. Louis Southwestern

No.	Size and capacity	Type of machine	Builder or dealer
2	16-in.	Tool room lathes	Lodge & Shipley Mach. Tool Co.
2	24-in.	Engine lathes	Lodge & Shipley Mach. Tool Co.
1	30-in.	Engine lathe	Boye & Emmes Mach. Tool Co.
2	20-in. by 40-in. by 10-ft	Extension bed gap lathe	Rahn-Larmon Co.
1	50-in.	Sliding head vertical drill	W. F. & J. Barnes Co.
1	32-in.	Heavy duty back geared shaper	Columbia Mach. & Tool Co.
2	36-in.	Draw cut shapers	Morton Mfg. Co.
1	52-in. by 14-in. by 20-in.	Swing plain milling machine	Kearney-Trecker Corp.
1	12-in. by 32-in.	Universal grinding machine	Landis Mach. Co.
1	4½-in. to 8-in. by 16-in.	Internal and link grinder	Gisholt Mach. Co.
1	½-in. to 4-in.	Drill grinder	Wilmarth & Marmon Co.
1	¼-in. to 2½-in.	Drill grinder	Wilmarth & Marmon Co.
1		Chaser grinder	Landis Mach. Co.
1	2-in.	Bolt cutter	Landis Mach. Co.
1	2½-in. to 6-in.	Hand pipe threading machine	Oster Mfg. Co.

No.	Size and capacity	Type of machine	Builder or dealer
2	20-in.	Brass lathes	Dreses Mach. Tool Co.
1	20-in.	Brass lathe	Bardons & Oliver
2	48-in.	Radial drill presses	Carlton Machine Tool Co.
2	5-ft.	Radial drill presses	Fosdick Mach. Tool Co.
1	24-in. 2-spindle	Drill press	Fosdick Mach. Tool Co.
2	36-in.	Drill presses	Aurora Tool Works
1	36-in.	Crank planer	Newton Mach. Tool Co.
1	38-in. by 38-in. by 16-ft.	Planer	G. A. Gray Co.
1	60-in. by 60-in. by 16-ft.	Planer	Liberty Mach. Tool Co.
1	32-in.	Shaper	Ohio Mach. Tool Co.
2	32-in.	Shapers	Cincinnati Shaper Co.
1	36-in.	Draw cut shaper	Morton Manufacturing Co.
1	15-in.	Slotter	T. C. Dill Mach. Co.
1	18-in.	Slotter	T. C. Dill Mach. Co.
1	14-ft, 4-in. by 50-in.	Horizontal boring machine	Niles-Bement-Pond Co.
1	15-ft., 2-in. by 35½-in.	Rod boring machine	Baker Brothers, Inc.
1		Precision boring machine	Lucas Machine Tool Co.
1	42-in.	Vertical boring machine	King Machine Co.
1	54-in.	Car wheel boring machine	Wm. Sellers & Co.
2	8-ft.	Vertical boring mills	Cincinnati Planer Co.
1	54-in.	Vertical milling machine	Ingersoll Milling Machine Co.
1		Key seat milling machine	Niles-Bement-Pond Co.
2	12-in. by 1¼-in.	Double end floor grinders	Hisey-Wolf Mach. Co.
16	18-in. by 3-in.	Double end floor grinders	Hisey-Wolf Mach. Co.
1		Cutter and reamer grinder	Wilmarth & Morman Co.
1	36-in.	Cold saw cut-off machine	Racine Tool & Mach. Co.
1	2½-in.	Bolt threading machine	Acme Machine Tool Co.
2	⅛-in. to 2-in.	Pipe threading machine	Oster Manufacturing Co.
1	1-in. to 4-in.	Pipe threading machine	Oster Manufacturing Co.
2	48-in., 600-ton	Car wheel presses	Niles-Bement-Pond Co.
1	108-in., 800-ton	Single end driving wheel press	Chambersburg Engineering Co.
2	50-ton	Power forcing presses	Lucas Machine Tool Co.
1	48-in.	Double end punch and shear	Chambersburg Engineering Co.
1	36-in.	Band saw	Oliver Machinery Co.
3	36-in.	Rip saws	Greenlee Bros. Co.
1	24-in.	Hand jointer	Sidney Mach. Tool Co.

Oregon Short Line

2	20-in. by 12-ft.	Engine lathes	Manning, Maxwell & Moore
1	18-in. by 10-ft.	Tool room lathe	Manning, Maxwell & Moore
1	32-in.	Heavy duty shaper	Manning, Maxwell & Moore
1	4½-in. by 6-ft.	Portable boring bar	Salt Lake Hardware Co.
1	⅝-in. by 7-in. by 72-in.	Universal spring boring machine	Jos. T. Ryerson & Son
1	3-in. by 3-in.	Tool grinding and shaping machine	Wm. Sellers & Co.
1	12-in.	Bench type motor grinder	The Caligher Machinery Co.
1	No. 100	Bradley cushioned helve hammer	F. C. Richmond Machinery Co.
1	12-in.	Horizontal punch and bender	Manning, Maxwell & Moore
1	No. 28	Buffalo slitting shear	Interstate Mach. & Supply Co.
1	No. 11	Buffalo special bar cutter	Interstate Mach. & Supply Co.
1	½-in. to 6-in.	Pipe and tube cutting off mach.	Jos. T. Ryerson & Son
1		Electric tube welder	Federal Machine & Welder Co.
1	⅜-in. by 12-ft. 1-in.	Steel power bending brake	Manning, Maxwell & Moore
1		Universal saw bench	Oliver Mach. Co.
1		Variety saw bench	Oliver Mach. Co.

Oregon-Washington Railroad & Navigation Co.

No.	Size and capacity	Type of machine	Builder or dealer
1	3-in. by 36-in.	Flat turret lathe	Jones & Lamson Mach. Co.
1	48-in.	Car wheel boring machine	Manning, Maxwell & Moore
1		Side milling head	Newton Mach. Tool Wks.
2		Bench universal woodworkers	J. D. Wallace & Co.

Panama Railroad

No.	Size and capacity	Type of machine	Dealer or maker
1		Punch and shear	New Doty Manufacturing Co.

Peoria & Pekin Union

No.	Size and capacity	Type of machine	Builder or dealer
1	16-in. by 6-ft.	Portable engine lathe	American Tool Works
1	42-in.	Vertical turret lathe	Marshall & Huschart Co.
1	36-in.	Draw cut shaper	Morton Manufacturing Co.
2		Floor grinders	J. G. Blount Co.
1	500-ton	Wheel press	Chambersburg Engineering Co.

Pennsylvania System

No.	Size and capacity	Type of machine	Builder or dealer
1		Double head axle lathe	
4		Engine lathes	
5		Turret lathes	

No.	Size and capacity	Type of machine	Builder or dealer
1	¾-in.	Pneumatic flanging machine	McCabe Mfg. Co.
3	No. 2	Post boring machine	J. A. Fay & Egan Co.
1	8-in.	Bench hand planing and jointing machine	J. A. Fay & Egan Co.
1	16-in.	Bench hand planing and jointing machine	J. A. Fay & Egan Co.
1	24-in. by 8-in.	Surface planer	J. A. Fay & Egan Co.
1	36-in.	Automatic cut-off saw	J. A. Fay & Egan Co.
4	36-in.	Band saws	J. A. Fay & Egan Co.
1	30-in.	Band saw	J. A. Fay & Egan Co.
1	27-in. by 8-in.	Rip saw	Greenlee Bros. & Co.
4	19-in. by 4¼-in.	Rip saws	J. A. Fay & Egan Co.

San Antonio & Aransas Pass

No.	Size and capacity	Type of machine	Builder or dealer
1	18-in.	Slotting machine	Newton Machine Tool Wks.

Southern

2	90-in.	Locomotive journal lathes	Niles-Bement-Pond Co.
1	Double head No. 3	Axle lathe	Niles-Bement-Pond Co.
1	Double head No. 2	Axle lathe	Niles-Bement-Pond Co.
1	16-in. by 9-ft.	Engine lathe	Lehmann Machine Co.
1	18-in. by 8-ft.	Engine lathe	American Tool Works
1	18-in. by 8-ft.	Engine lathe	Boye-Emmes Mach. Tool Co.
1	18-in. by 10-ft.	Engine lathe	Cincinnati Lathe & Toole Co.
1	18-in. by 14-ft.	Engine lathe	Cisco Machine Tool Co.
1	24-in. by 8-ft.	Engine lathe	Cisco Machine Tool Co.
1	24-in. by 8-ft.	Engine lathe	Lehmann Machine Co.
1	24-in. by 14-ft.	Engine lathe	Reed-Prentice Co.
1	24-in. by 15-ft.	Engine lathe	Reed-Prentice Co.
1	30-in. by 16-ft.	Engine lathe	Cincinnati Lathe & Tool Co.
2	36-in. by 16-ft.	Engine lathes	R. K. LeBlond Mach. Tool Co.
1	42-in. by 8-ft.	Engine lathe	Niles-Bement-Pond Co.
2	15-in. by 31-in.	Portable engine lathes	R. K. LeBlond Mach. Tool Co.
1	3¼ by 29-in.	Universal turret lathe	Warner & Swasey Co.
1	7½-in. by 26-in.	Turret lathe	International Machine Tool Co.
1	6¼-in. by 34-in.	Turret lathe	Gisholt Machine Co.
3	3-in. by 36-in.	Turret lathes	Jones & Lamson Machine Co.
1	90-in.	Driving wheel lathe	Niles-Bement-Pond Co.
2	26-in. to 52-in., No. 4	Car wheel lathes	Niles-Bement-Pond Co.
1	13-in.	Tool room lathe	Pratt & Whitney
1	16-in.	Tool room lathe	Pratt & Whitney
1	17-in.	Tool room lathe	R. K. LeBlond Mach. Tool Co.
2	18-in.	Universal monitor lathes	The Dreses Mach. Tool Co.
2	20-in.	Universal monitor lathes	The Dreses Mach. Tool Co.
4	48-in.	Radial drills	Reed-Prentice Co.
1	60-in.	Radial drill	Niles-Bement-Pond Co.
4	60-in.	Radial drills	Ridgeway Manufacturing Co.
3	72-in.	Radial drills	Niles-Bement-Pond Co.
1	72-in.	Radial drill	Ridgeway Manufacturing Co.
1	20-in.	Upright drill press	Rockford Machine Tool Co.
3	26-in.	Upright drill presses	W. G. & John Barnes Co.
1	28-in.	Upright drill press	Rockford Machine Tool Co.
1	14-in.	High speed sensitive drill press	Chas. G. Allen Co.
1	6-in. to 14-in., No. 513	Heavy drill press	Baker Brothers, Inc.
1	6-in.	Centering machine	Pratt & Whitney
2	36-in. by 36-in. by 10-ft.	Planers	Niles-Bement-Pond Co.
1	36-in. by 36-in. by 14-ft.	Planer	Niles-Bement-Pond Co.
1	42-in. by 42-in. by 12-ft.	Planer	Niles-Bement-Pond Co.
2	72-in. by 72-in. by 14-ft.	Planers	Niles-Bement-Pond Co.
1	1½-in. by 16-ft., No. 3	Plate planer	Hilles & Jones Co.
1	32-in.	Draw-cut shaper	Morton Manufacturing Co.
3	32-in.	Shapers	Columbia Machine Tool Co.
2	32-in.	Shapers	Gould & Eberhardt
1	32-in.	Shaper	Cincinnati Shaper Co.
3	36-in.	Draw-cut shapers	Morton Manufacturing Co.
2	24-in.	Slotters	Niles-Bement-Pond Co.
4	30-in.	Vertical boring mills	Gisholt Machine Co.
1	44-in.	Vertical boring mill	Niles-Bement-Pond Co.
2	53-in.	Vertical boring mills	Niles-Bement-Pond Co.
1	84-in.	Vertical boring mill	Niles-Bement-Pond Co.
1	9-in. to 12-in.	Driving box boring & facing mach.	Wm. Sellers & Co.
2	36-in. to 44-in.	Side head boring mills	Niles-Bement-Pond Co.
2	48-in.	Car wheel boring mills	Putnam Machine Works
1	36-in. by 10-ft.	Horizontal milling machine	Newton Machine Tool Co.
2	42-in. by 30-in. by 16-ft.	Horizontal milling machines	Ingersoll Milling Machine Co.
1	No. 2-M	Universal milling machine	Cincinnati Milling Mach. Co.
1	No. 4	Universal milling machine	Cincinnati Milling Mach. Co.
2	54-in. by 42-in.	Rotary type milling mach.	Ingersoll Milling Mach. Co.
1	42-in. by 12-in.	Keyseating and cottering mach.	Newton Machine Tool Works

Southern (Continued)

No.	Size and capacity	Type of machine	Builder or dealer
1	18-in. by 30-in. by 96-in.	Piston rod grinder	Norton Co.
4	No. 2	Int. radius and link grinders	Rockford Milling Machine Co.
1	84-in.	Heavy guide box grinder	Diamond Machine Co.
1	8-in. by 1-in.	Double end dry grinder	J. G. Blount Co.
2	16-in. by 2-in., No. 76	Floor grinders	Safety Emery Wheel Co.
2	24-in. by 3-in., No. 84	Wet tool grinders	Safety Emery Wheel Co.
1	No. 1	Univ. tool grinder and shaping mach.	Wm. Sellers & Co.
1		Chaser grinder	Geometric Tool Co.
1	3-in.	Twist drill grinder	Wm. Sellers & Co.
1	15-in. by 2-in., No. 2	Swing frame grinder	Springfield Manufacturing Co.
1	12-in.	Power cold saw	Espen-Lucas Co.
1	6-in. by 6-in.	High speed hack saw machine	Peerless Machine Co.
1	10-in.	Crank pin turning machine	Edwards Machine Works
3	Six spindle	Radial stay thread. & turn. mach.	The Harrington Co.
7	2-in.	Double head bolt cutters	Acme Machinery Co.
1	⅜-in. to 4-in., No. 304-B	Pipe threading machine	Oster Manufacturing Co.
1	1½-in., 4-spindle	Nut tapper	Acme Machinery Co.
1	⅜-in. to 2-in.	Nut facing machine	Victor Tool Co.
1	400-ton, 54-in.	Car wheel press	Chambersburg Engineering Co.
1	600-ton	Driving wheel press	Southworth Foundry & Mach. Co.
1	800-ton	Driving wheel press	R. D. Wood & Co.
5	100-ton	Hydraulic bushing presses	Niles-Bement-Pond Co.
1	800-lb.	Single frame steam hammer	Niles-Bement-Pond Co.
2	1,500-lb.	Single frame steam hammers	Niles-Bement-Pond Co.
1	2,500-lb.	Single frame steam hammer	Niles-Bement-Pond Co.
2	3,400-lb.	Single frame steam hammers	Niles-Bement-Pond Co.
5	500-lb.	Helve hammers	C. C. Bradley & Sons
2	12-in. by 63 in., No. 26	Bulldozers	Williams, White & Co.
1	1¼-in.	Bolt heading machine	Williams, White & Co.
1	1½-in.	Bolt heading & forging mach.	Williams, White & Co.
1	3½-in.	Forging machine	Ajax Manufacturing Co.
1	48-in. by 1½-in. by 1-in. EF	Single end punching mach.	Cleveland Punch & Shear Co.
2	48-in. by 1½-in. by 1¼-in., G	Single end punching mach.	Cleveland Punch & Shear Co.
2	48-in., 1¼-in. by 1¼-in.	Single end punching machines	Cleveland Punch & Shear Co.
1	48-in. by 1¼-in. by 1 in., EF	Single end shear	Cleveland Punch & Shear Co.
2	48-in., 1¼-in. by 1¼ in., G	Single end shearing machines	Cleveland Punch & Shear Co.
2	18-in., 2-in. by 1½-in.	Combined punch & shears	New Doty Manufacturing Co.
1	6-in.	Single end angle shears and punch	Buffalo Forge Co.
1	⅜-in. by 60-in., No. 37	Plate shear with punch attach.	Williams, White & Co.
2	2¼-in.	Flue welders	Thomson Spot Welder Co.
1	2½-in.	Flue welder	Thomson Spot Welder Co.
1	5½-in.	Flue welder	Draper Manufacturing Co.
1		Fit type flue cleaner	Jos. T. Ryerson & Sons
1	¾-in.	Sheet flanging machine	McCabe Manufacturing Co.
1	3½-in.	Horizontal bending roll	Southwark Foundry & Mach. Co.
1	4-in. by 4-in. by ½-in., No. 1	Angle bending roll	Jos. T. Ryerson & Sons
1	No. 6	Jackson die sinking mach.	Walcott Lathe Co.
1	3-in. by 16-in., No. 378B	Five spindle car boring mach.	J. A. Fay & Egan Co.
1	1-in. by 10-in., No. 284	Vertical mortiser	Wysong & Miles Co.
2	18 in. by 18 in.—½-in. to 3-in.	Vertical mortisers	J. A. Fay & Egan Co.
1	36-in. by 7-in., No. 156	Single cyl. surfacer	J. A. Fay & Egan Co.
2	15-in. by 6-in., No. 474	Planer and matchers	J. A. Fay & Egan Co.
1	16-in. by 20-in., No. 342	Vertical car sill tenoner	J. A. Fay & Egan Co.
1	7-in. by 3¾-in.	Combination saw and dado mach.	J. A. Fay & Egan Co.
2	18-in. by 11-in., No. 364	Automatic cutoff saws	J. A. Fay & Egan Co.
2	21-in. by 13-in., No. 3	Self feed rip saws	J. A. Fay & Egan Co.
2	22-in. by 7½-in., No. 4	Band scroll & resawing mach.	J. A. Fay & Egan Co.
1	36-in. by 42-in., No. 500	Variety saw	J. A. Fay & Egan Co.
1	36-in.	Wood cutting band saw	J. A. Fay & Egan Co.
1	12-in., No. 515-A	Universal woodworker	J. A. Fay & Egan Co.
1	42-in. by 8-ft. 6-in.	Door and blind clamp	Newman Machine Co.
2	24-in. by 20-in., No. 331	Car gaining machines	J. A. Fay & Egan Co.
1	2⅜-in., 2-spindle	Friezer and shaper	J. A. Fay & Egan Co.
1	42-in. by 6-in., No. 493	Single drum sandpapering mach.	J. A. Fay & Egan Co.
1	42-in. by 6-in., No. 399	Double drum sandpapering mach.	J. A. Fay & Egan Co.
1	4-in. sq., No. 326	Sash sticker and moulder	J. A. Fay & Egan Co.
1	12-in. by 6-in.	Heavy 4-side molder	Newman Machine Co.
2	24-in. by 14-in., No. 290	Timber dressers	J. A. Fay & Egan Co.

Spokane, Portland & Seattle

1	30-in. by 20-ft.	Engine lathe	Lodge & Shipley Mach. Tool Co.
1	3-in. by 36-in. by 15-in.	Turret lathe with auto. die	Jones & Lamson Mach. Co.
1		Universal milling machine	Kearney-Trecker Corp.
1	2-in.	Double head bolt threader	Landis Mach. Co.

Sugar Land

1	20-in.	Engine lathe	Jos. T. Ryerson & Son
1	20-in.	Drill press	Mechanics Tool Co.
1	28-in.	Drill press	Mechanics Tool Co.
1		Crank shaper	Rockford Tool Co.
1	36-in.	Band saw	
1	6-in. by 6-in.	Hack saw	Wm. Robertson & Co.
1		Threading machine	Greenfield Tap & Die Corp.

Toronto, Hamilton & Buffalo

No.	Size and capacity	Type of machine	Builder or dealer
1		Axle lathe	J. Bertram & Sons
1		Grinder	Ransom Mfg. Co.
1		Flue rattler	Hamilton Engineering Service.

Union Pacific

No.	Size and capacity	Type of machine	Builder or dealer
1	45-in.	Journal and axle lathe	Niles-Bement-Pond Co.
1		Double axle lathe	Niles-Bement-Pond Co.
2	18-in. by 10-ft.	Engine lathes	Manning, Maxwell & Moore
1	18-in. by 12-ft.	Engine lathe	Manning, Maxwell & Moore
1	20-in. by 12-ft.	Engine lathe	Manning, Maxwell & Moore
1	36-in. by 16-ft.	Engine lathe	Manning, Maxwell & Moore
1	42-in. by 18-ft.	Heavy duty engine lathe	Niles-Bement-Pond Co.
1	4-ft.	Morris radial drill	Niles-Bement-Pond Co.
1	36-in.	Sliding head drill press	Niles-Bement-Pond Co.
1	22-in.	Vertical drill presses	Manning, Maxwell & Moore
1	36-in. by 36-in. by 14-ft.	Planer	Niles-Bement-Pond Co.
2	32-in.	Heavy duty shapers	Manning, Maxwell & Moore
1	28-in.	Heavy duty shaper	Manning, Maxwell & Moore
1	18-in.	Crank slotter	Hendrie & Bolthoff Mfg. & Sup. Co
1	48-in.	Car wheel boring machine	Manning, Maxwell & Moore
1	100-in.	Vertical boring and turning mill	Consolidated Mach. Tool Corp.
1	48-in.	Putnam car wheel borer	Manning, Maxwell & Moore
1	Type J.	Car wheel grinding machine	Hendrie & Bolthoff Mfg. & Sup. Co.
1	4-spindle	Internal grinding machine	Manning, Maxwell & Moore
1		Double end emery grinders	Manning, Maxwell & Moore
1	4½-in. by 8-ft.	Portable cyl. boring bar	E. C. Cummings Co.
1	10-in.	Centering machine	Niles-Bement-Pond Co.
1	2-in.	Triple bolt threader and tapper	Niles-Bement-Pond Co.
1	2½-in.	Double bolt cutter	Niles-Bement-Pond Co.
1		National die sharpener	Manning, Maxwell & Moore
1	600-ton	Hydraulic wheel press	Manning, Maxwell & Moore
1	No. 3½	Cabinet mortising machine	J. A. Fay & Egan Co.
1	6-in. by 24-in.	Cabinet tenoner	Greenlee Bros. & Co.
2	6-in.	Bench jointers	J. D. Wallace & Co.

Union Refrigerator Transit Co.

No.	Size and capacity	Type of machine	Builder or dealer
1		Vertical car borer	Greenlee Bros. & Co.

Wabash

No.	Size and capacity	Type of machine	Builder or dealer
2	18-in.	Engine lathes	Colcord-Wright Machy. & Sup. Co.
1	24-in.	Engine lathe	Colcord-Wright Machy. & Sup. Co.
1	20-in.	Brass turret lathe	Colcord-Wright Machy. & Sup. Co.
1	15-in. by 6-ft.	Bolt lathe	Niles-Bement-Pond Co.
1	6-ft.	Radial drill	Niles-Bement-Pond Co.
2	⅞-in.—12-in. reach	High speed drill presses	Blackman-Hill-McKee Mach. Co.
1		Vertical drill press	Niles-Bement-Pond Co.
1	8-in.	Drilling and centering machine	Blackman-Hill-McKee Mach. Co.
1	32-in.	Shaper	Elliott & Stephens Mach. Co.
1	36-in.	Draw cut shaper	Morton Mfg. Co.
1		Milling machine	Blackman-Hill-McKee Mach. Co.
2		Automatic hack saws	Armstrong-Blum Mfg. Co.
1		Pipe machine	Manning, Maxwell & Moore
1	100-ton	Hydraulic forcing press	Manning, Maxwell & Moore
1		Punch and shear	Blackman-Hill-McKee Mach. Co.
1	4½-in.	Bar shear	Blackman-Hill-McKee Mach. Co.
1	¾-in.	Flanging machine	McCabe Mfg. Co.

Western Pacific

No.	Size and capacity	Type of machine	Builder or dealer
1	4¼-in. by 8-in. to 6-in. by 11-in.	Portable journal truing mach.	W. C. Dunn Co.
2	3-in. by 20-in.	Single end wet grinders	Blount Mach. Co.
1	3-in. by 18-in.	Double end dry grinder	Jos. T. Ryerson & Son
1	75-ton	Hydraulic press	Chambersburg Engineering Co.

Wheeling & Lake Erie

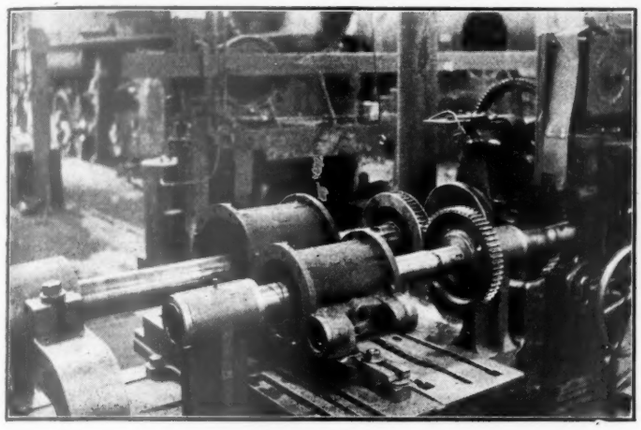
No.	Size and capacity	Type of machine	Builder or dealer
2	18-in. by 8-ft.	Engine lathes	Cincinnati Lathe & Tool Co.
1	24-in.	Drill press	Aurora Tool Works
1	26-in.	Drill press	Aurora Tool Works

Boring bar for compound pump cylinders

By E. A. Murray

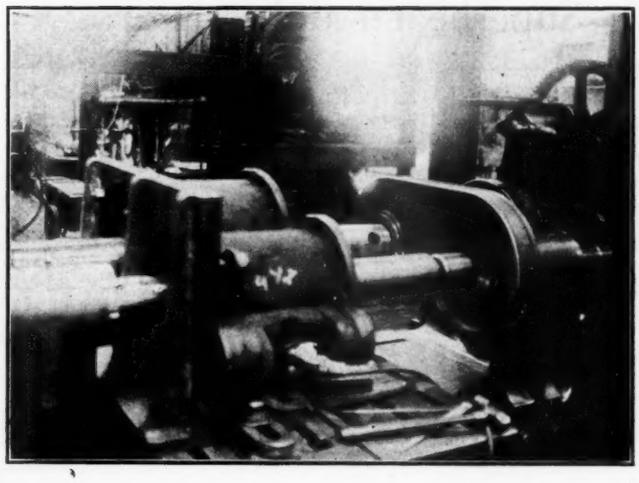
Shop Superintendent, Chesapeake & Ohio, Huntington, W. Va.

MANY original devices have been developed from time to time in railroad repair shops for reboring the cylinders of cross-compound air pumps. The majority of these boring bars, however, are designed to bore only one of the two cylinders at a time. The drawing and illustrations to this article show the details as well as the operation of a boring bar which has been designed for handling this work in the Huntington shops of the Chesapeake & Ohio, and it differs from many others in that it performs the operation of boring both cylinders at one time.



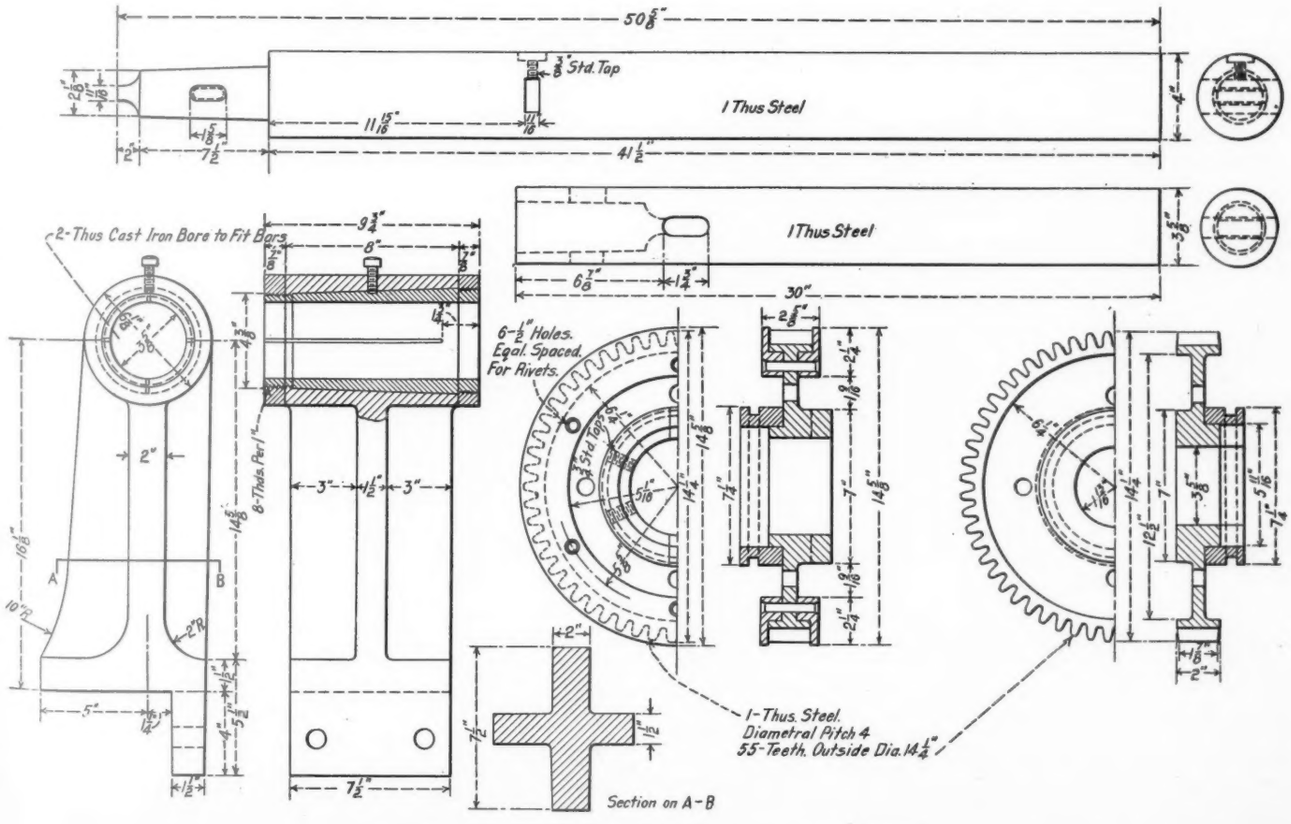
General arrangement of boring bars with gear cover and angle bracket removed

The device as a whole is simple to construct and to apply. It is intended for application to a horizontal boring mill, and consists of two parallel boring bars, one of which is driven from the spindle of the boring mill and the other, in turn, is driven by a flanged gear on the main bar which meshes with a gear on the auxiliary bar. Both bars are suitably supported by bearing brackets fastened to the table of the machine. The function of the flanged gear is to transmit to the auxiliary bar both the revolving motion for making the cut and the horizontal motion for the feed.



The cylinder casting is bolted to an angle bracket on the machine bed

In actual practice the air pump cylinders are bolted to an


1 Thus Steel
2-Thus Cast Iron Bore to Fit Bars
6-1/2" Holes. Equal Spaced. For Rivets.
8-Thds. Per 1"
1-Thus. Steel. Diametral Pitch 4. 55-Teeth. Outside Dia. 14 1/4"
Section on A-B

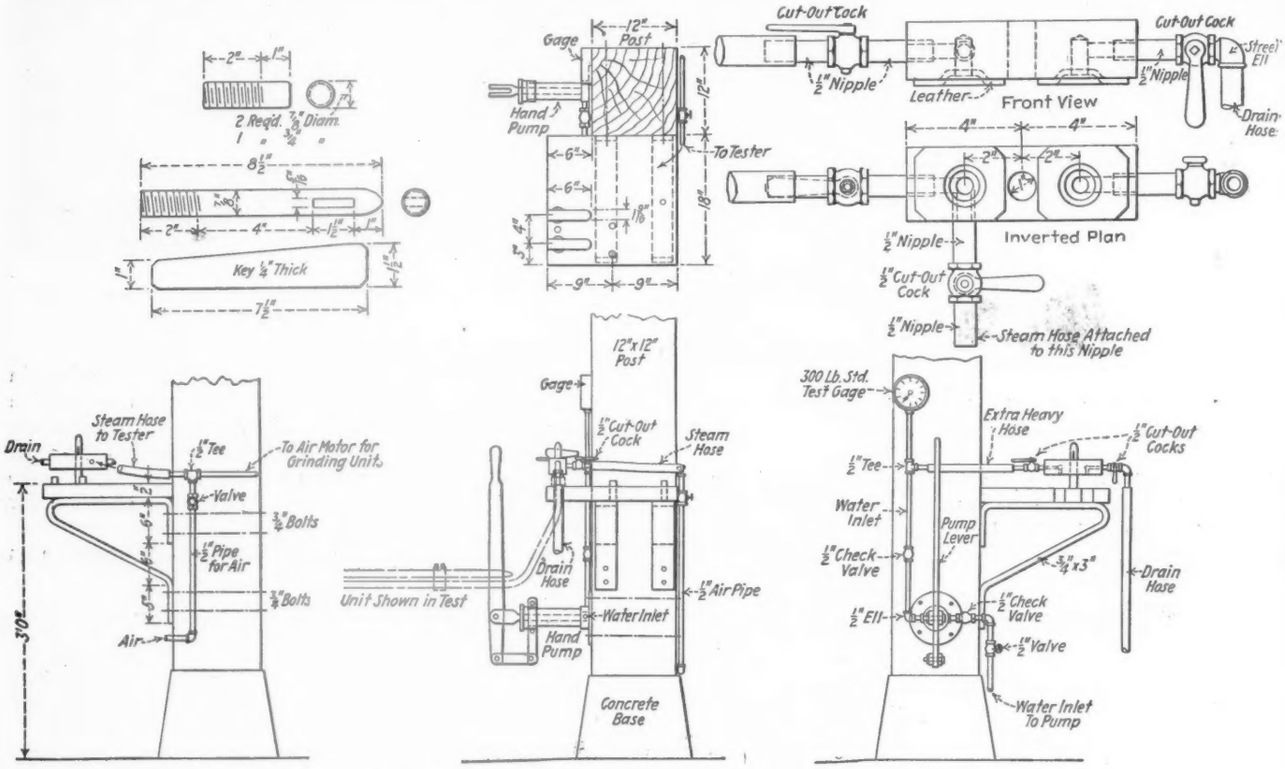
Details of construction of boring bars, gears and bracket

angle plate on the machine bed after which the bars are lined up to bore both cylinders at one operation. It has been found possible to reduce the time required on this job by about 50 per cent by the use of this device.

Superheater unit test rack

IN the drawing accompanying this article is shown a remarkably simple yet efficient device developed for testing superheater units. It was designed and constructed at the Minneapolis shops of the Chicago, Milwaukee and St. Paul.

As shown in the drawing, the rack rests on a bar iron bracket which can be fastened to a convenient column in the shop. On the bracket is a block with two slots for the unit pipes. This block, or table plate, is stationary and a 7/8-in. bolt with key slot is screwed into it. The superheater unit is inserted in the slots in the table plate, the cap is slipped down over the key bolt on to the ball joints of the unit and a tapered key is driven into the slotted bolt with a slight hammer blow which forces the cap down on the joints. Pressure is applied by means of a small hand pump conveniently located for the operator to handle. Valves and cut-out cocks are so arranged that the units may be filled with water and pressure pumped up for hydrostatic test and when the test is completed the water and scale can be blown out into a drain.



Constructional details of test rack for superheater units

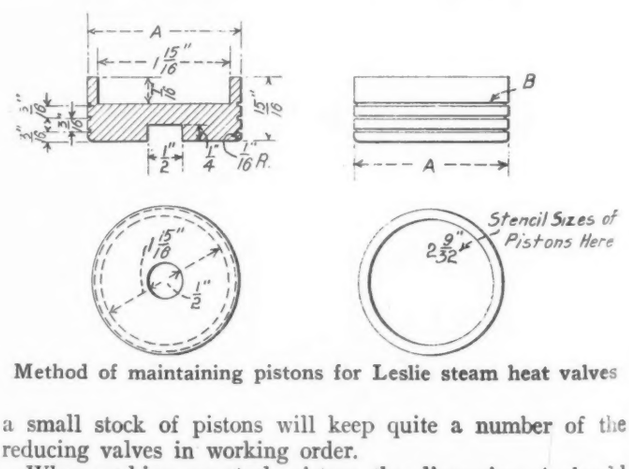
THE LOCOMOTIVES inspected by the Bureau of Locomotive Inspection in November numbered 5,143, of which 2,366, or 46 per cent, were found defective and 283 were ordered out of service, according to the Interstate Commerce Commission's monthly report to the Senate on the condition of railway equipment. Of 98,723 freight cars inspected by the Bureau of Safety 3,582 were found defective and of 1,773 passenger cars 15 were found defective. During the month 38 cases, involving 253 violations of the safety appliance acts, were transmitted to various United States attorneys for prosecution.

Reducing valve piston repairs

By Frank Bentley

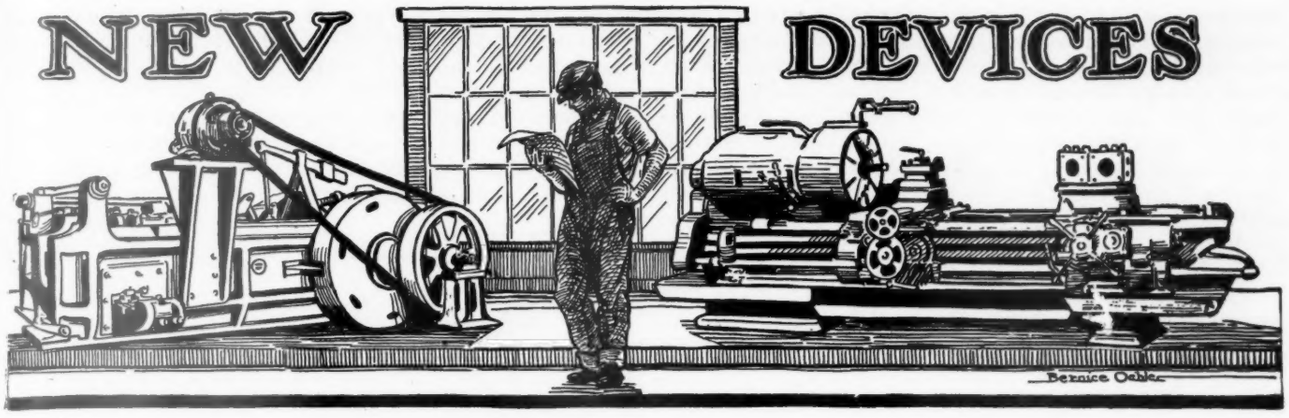
A GREATER part of the efficiency of the steam heat reducing valve depends on the main valve piston. If properly repaired when required, it will be kept off of the engineman's report slip as well as off the repair bench.

In order to prepare for the winter months a number of odd size stock pistons are made up early in the fall. The sizes in 1/32 in. are stenciled on the piston in the hollow portion of the top. The valve body is, of course, held on a mandrel as the cylinder is trued up. A piston of the proper diameter is selected for the size to which the worn portion is bored out. The removed pistons can be used for cylinders which true up to smaller sizes. By following this practice a small stock of pistons will keep quite a number of the reducing valves in working order.



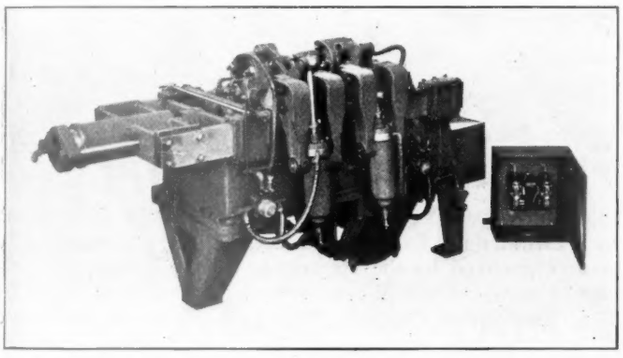
Method of maintaining pistons for Leslie steam heat valves

When making up stock pistons the dimension *A* should be made up in sizes of 2 9/32 in., 2 5/16 in., 2 11/32 in., and 2 3/8 in. The grooves *B* should be 1/32 in. square.



Electric butt welder with a water-cooled transformer

THE three accompanying illustrations show the No. 92 electric butt welder manufactured by the Federal Machine & Welder Company, Warren, Ohio. The machine is supplied with a remote control, magnetically operated switch, so designed that the metal

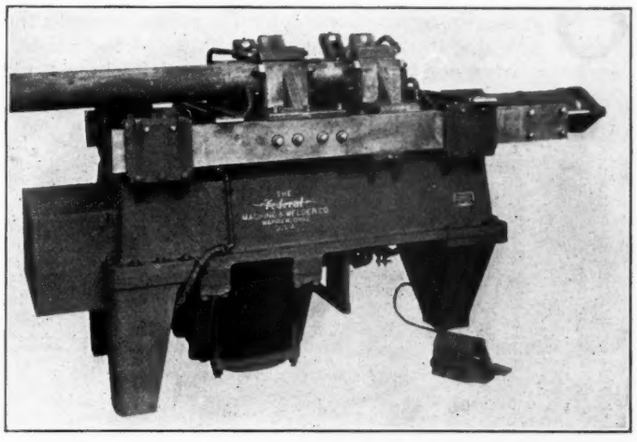


Rear view showing air cylinders and remote control switch in steel box

contacts are readily removed and replaced with slight expense. The switch has asbestos-wood flash plates, to prevent the arc from blowing out from the contacts when the circuit is open under heavy load and is also supplied with magnetic blow-outs, which extinguishes the arc. The switch is mounted on a heavy slate base, which is installed in a steel box, having a door arranged for locking to avoid tampering with the switch. A small shunt switch is supplied as part of the regular equipment. This is mounted directly on the operating lever, or at a convenient point on the welding machine.

The machine is supplied with a cylinder of the proper dimensions to give pressure capacity at the welding jaws of 3,000 lb. per sq. in. up to the given capacity of the machine, or the cylinder will have a capacity to apply 13,400 lb. pressure at the welding jaws, when supplied with 1,800 lb. pressure on the hydraulic line.

The transformer consists of heavy cast copper secondaries entirely surrounding the core and insulated from it with bakelite strips. Each section of these secondaries is supplied with a water cooling pipe which extends through its entire length. The secondaries are divided into three sections which are placed between four primary coils. The primary coils are wound with copper ribbon, the turns of which are insulated from each other with oiled muslin and asbestos ribbon. The coils complete are covered throughout with asbestos tape to make them fire and water proof. The insulation between the primary and secondary coils consists of a flexible material made up of asbestos fibre ⅛ in. thick, which has a break-down test of 20,000 volts. The entire set of transformer coils is mounted on the transformer core which is machined in sections, and the coils can be readily removed, in case it is desirable to dismantle the transformer. The core is made of high silicon, non-ageing transformer steel, having a low core loss. The entire equipment is air cooled. If the welders are equipped with a 100 k.v.a.



Welding a locomotive superheater tube in a Federal butt welder

capacity transformer it will have sufficient capacity to weld continuously 4½ sq. in. of metal.

The transformer is mounted under the movable main platen or slide in such a manner that it is impossible for dirt, flash or refuse coming from the weld to get in the windings of the transformer. It has been found that with the transformer located directly underneath the gap between the movable slides, the flash or throw-up from the weld falls directly on it and the strong magnetic pull induced by the secondary under the flow of the immense amperage has a tendency to pull the metallic dust into

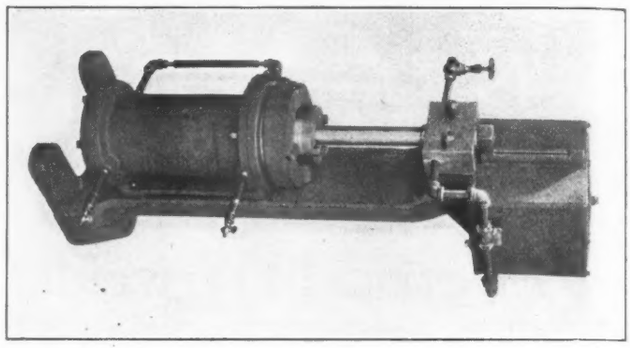
the windings, finally resulting in burn-outs or short circuits. It is claimed that this difficulty has been entirely eliminated in this machine as the transformer is not located under the slides and is further protected by a heavy slate slab, which extends directly from the under slide of the platen down nearly to the floor. The only parts of the electrical secondary that are exposed to the throw-off from the weld, are three heavy copper secondary connections, which extend to the left hand stationary electrode.

The welding machine has a three point bearing, that is, two legs on one end and one on the other. The four legged construction, unless very carefully installed, throws a twist in the machine, resulting in a binding of the slides and unsatisfactory work due to improper alinement.

The main movable platen or slide is carried on two heavy steel bars which extend the full length of the machine, giving a bearing between the sliding contacts of approximately 5 ft. 6 in. and at the same time placing the main bearings at the extreme ends of the machine where they are entirely out of the way of dirt and flash which is thrown off at the weld.

The transformer being supported directly under the movable slide and not enclosed in an oil-cooled case, is readily inspected and accessible for blowing out of whatever dirt may accumulate after long use. The main bearings which are of heavy steel construction are located at the outer ends of the machine and are easy to adjust and are arranged for proper lubrication by means of the Alemite system. An Alemite grease gun to lubricate all of the moving parts is supplied with the welder.

The machine is constructed with dies of the circular pattern design, held in position by wedge shaped clamps. The dies are located in holders which are supplied with water-cooling pipes. The water is permitted to flow through these holders at all times when doing heavy work, or handling the machine up to its full capacity. The pressure in clamping the pipe is applied with the aid of a toggle lever and air operating cylinder, eliminating the labor necessary in clamping large size pipe by hand. The actual pressure applied when clamping tubes is approximately 16 tons on each clamp. The circular shape of the dies provides proper alinement at all times.



Hydraulic intensifier used with the butt welder

The construction of the machine is such that the disposition of the frame to buckle is a remote possibility. The operating cylinder is so installed that a straight pull is applied to the moving platen and this, with the aid of the long bearing, eliminates the tendency to spring the bed plate.

Universal truck column anchor

ONE frequent source of trouble with arch bar trucks is the breaking of the columns on the inside at the top, due to repeated hammer blows of the bolster. Moreover, when the brakes are hung from the columns, the ears or support brackets are not infrequently worn through by the hanger pins or broken off.

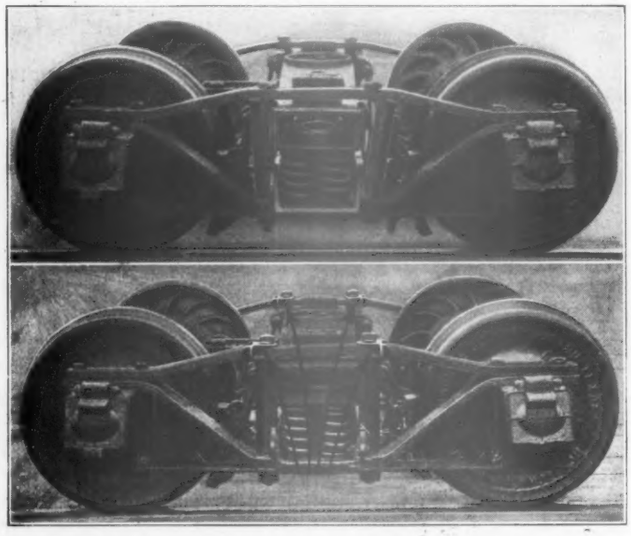


Fig. 1—Arch bar truck with broken columns (above); Same truck with broken columns held in place by Universal truck column anchors (below)

The cost of renewing truck columns when broken is considerable, depending on the weight and material from which they are made. Their period of usefulness is said to be greatly extended by the application of Universal truck column anchors, developed recently by the Universal Draft Gear Attachment Company, Chicago. By the use of these anchors the truck columns are supported at the top from the outer face and even if broken out on the inner face they are still serviceable. In fact, the defective columns, when supported at the top with these anchors, are said to be stronger than new columns without the anchors. In cases where the brake hanger bracket has been broken off, the truck column anchor is provided with an integral brake hanger support, thus making a permanent repair and retaining the old column.

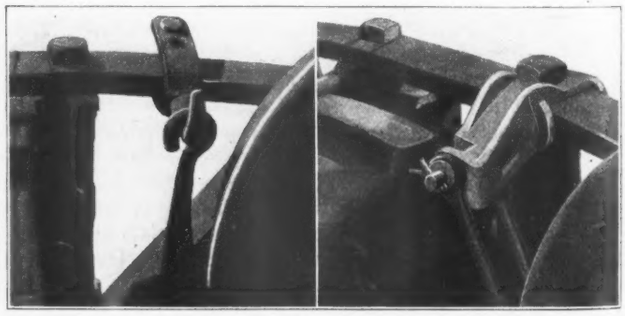


Fig. 2—Temporary repairs in case of broken brake hanger bracket (left) and permanent repairs (right) by means of Universal truck column with integral brake hanger bracket

In the upper part of Fig. 1 an arch bar truck is illustrated with all four columns broken out on the inner face as described. The same truck, fitted with Universal truck column anchors, by means of which necessary repairs are made and the old columns retained, is shown in the lower half of the illustration.

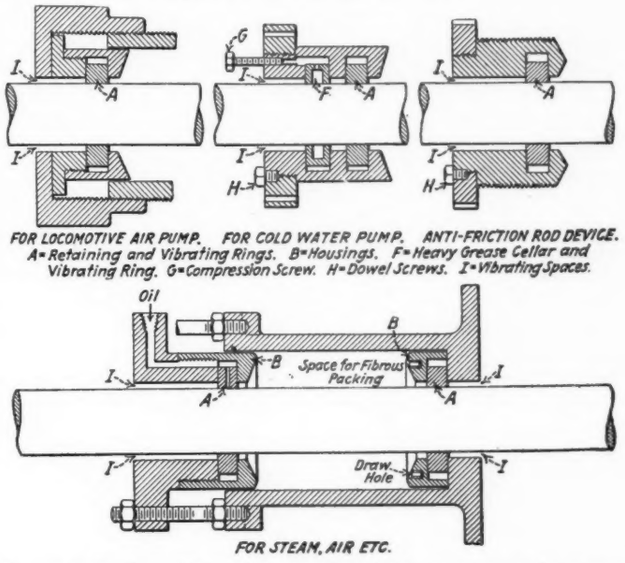
A truck with temporary repairs in case of a broken brake hanger bracket is illustrated at the left in Fig. 2, and at the right, the method of making permanent repairs by means of a Universal truck column anchor with integral brake hanger bracket which provides a permanent rigid support for the brake beam.

Packing gland provides for improper alinement

THE two main sources of packing troubles are improper alinement of machinery and improper adjustment of the compression gland by the operator. Few operators use calipers in making adjustments. Where calipers are not used, the operator invariably puts more tension on one adjustment nut than on the other, which results in a scored rod and cut packing. In trying to overcome this condition, the workman will apply more pressure in the gland. Unnecessary pressure is applied to the rod and more power is required to operate the machinery and, with this condition, the packing must be frequently renewed and eventually the scored rod must be removed or turned which undoubtedly increases the cost of packing gland maintenance.

In an effort to overcome these conditions William S. Sudekum, Nashville, Tenn., has developed and patented a packing gland to take care with an anti-friction rod device of improper alinement. Referring to the illustration showing the application of the device to steam, air and other glands, it will be noticed that the fibrous packing is cut at an angle of 45 deg. The object is to obtain a perfect fit with the least possible compression. The glands are bored no less than ¼ in. larger than the piston rod to prevent them from coming in contact with the rod.

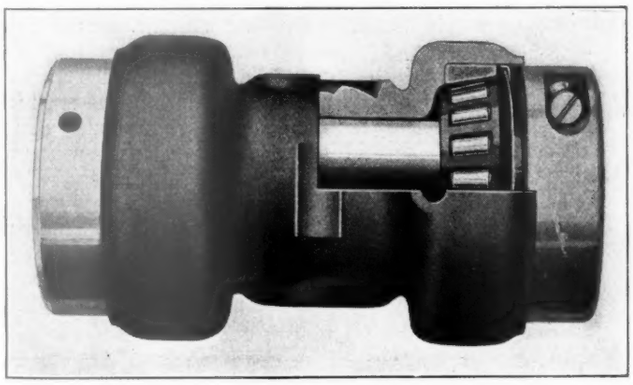
The retaining or vibrating rings are turned ¼ in. smaller than the bore in the housing in order that the rings may have the same amount of vibrating space as the rod. The packing is lubricated through the feed oil cup which is said to be economical as the vibrating rings will distribute the oil on the rod properly and without waste.



A method of packing piston rods which overcomes improper alinement of machinery and adjustment of the compression gland

Roller bearing for line shaft hangers

THE Dodge Manufacturing Corporation, Mishawaka, Ind., has placed on the market a line shaft bearing embodying the Timken tapered roller bearing, as well as several new features of construction.



Line shaft hanger bearing equipped with Timken tapered roller bearings

The special requirements that must be met by any appliance used in power transmitting service, such as ruggedness, simplicity, interchangeability and reliable lubrication, have been given the most careful consideration in the design and manufacture of this bearing. It consists of only five parts; two Timken tapered roller bearings mounted on a ground and slotted steel tube and fitted to an accurately machined housing. The ends of the steel tube are threaded to receive clamping collars designed to secure accurate adjustment of the bearings on the tube. This adjustment is made at the factory and need not be altered by the user.

The mounting of the tapered roller bearings, as described, insures full utilization of the bearings for both radial and thrust loads. It also adds to the ruggedness of the assembly and is of particular value in resisting the side weave of heavy driving belts. The method of fastening the steel tube or sleeve to the shaft permits its use on any commercial shafting. This fastening is accomplished by simply setting up the screws in each of the two clamping collars.

The sleeve on which the bearings are mounted extends from end to end of the housing. Liberal grease compartments are provided inside of the housing and outside of the tube. The outer ends of the bearings are protected against dust by special metallic grease seals which eliminate friction at this point and prevent dust working in or

the lubricant from working out. These grease seals take the place of felt washers or packing.

The erection of this lineshaft bearing is very simple. It is only necessary to slip the bearing over the shaft and set up the clamping screw in each of the split clamping collars. To remove it, in order to make any necessary repairs, the screws in the collars are loosened and the bearing slipped off the shaft.

Quartering gage with vernier attachment

PAGE 1407 of the June 11 issue of the Daily Railway Age contains a description of the improved quartering gage manufactured by The Ashton Valve Company, Boston, Mass. Since then the instrument has been further improved by the addition of a vernier attachment and an outside revolving casing. The gage can be used for testing crank pins for quartering in any position of the drivers without removing them from the frames; for checking the quartering of crank pins before setting the eccentric or crank arms of the valve motion; and it can be used to advantage when applying new axle to old wheel centers.

Each space upon the dial indicates one degree. Each space upon the vernier scale is six minutes or .1 degree shorter than one space on the dial scale. Thus, when the line marked zero on the vernier scale coincides with the line marked zero on the dial scale, the instrument is standing horizontally. When the dial is moved so that the graduation or line on the vernier scale next to the zero line coincides with the graduation next to the zero graduation on the dial scale, the included angle of the center line of the instrument and the horizontal center line has changed .1 degree or six minutes. To read the setting of the instrument, read directly from the dial scale, the number of whole degrees between the zero line, and the zero line of the vernier scale. Then count in the same direction, the number of graduations from the zero of the vernier scale to a graduation that coincides with a graduation on the dial scale; multiplying this number by six gives the number of minutes to be added to the number of whole degrees.

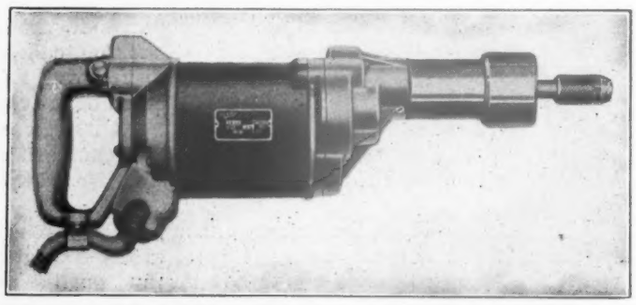
A table on the casing of each gage gives the linear variation corresponding to one degree of angular variation for the different strokes from 18 in. to 32 in. Provision has been made for suspending the gage from the crank pin by the use of a coil spring or strap.

Ashton locomotive driving wheel quartering gage provided with a revolving casing and vernier scale

Electric friction head screw driver

AN electric screw driver, the driving head of which is equipped with a disc type friction clutch, which is regulated automatically by pressure applied by the operator, has been placed on the market by the Hisey-Wolf Machine Company, Cincinnati, Ohio.

It is equipped with ball bearings throughout and designed with the company's universal motor for operation on direct current, or single phase alternating current of the same voltage, and for any frequency from 25 to 60 cycles. The quick-cable external connector is a feature which permits cable repairs and renewals without dismantling the machine. The switch is fitted to the handle grip. The clutch casing is of convenient size and serves as an end grip when the work requires. The screw slot finding attachment, which may be secured with the machine, is intended to prevent the driving bit from slipping out of the screw slot and marring the surface of the work. These are made in three sizes with bits 5/16 in., 3/8 in. and 7/16 in. diameter. Two screw driving bits are furnished with the machine.



Friction head screw driver fitted with a slot finding attachment

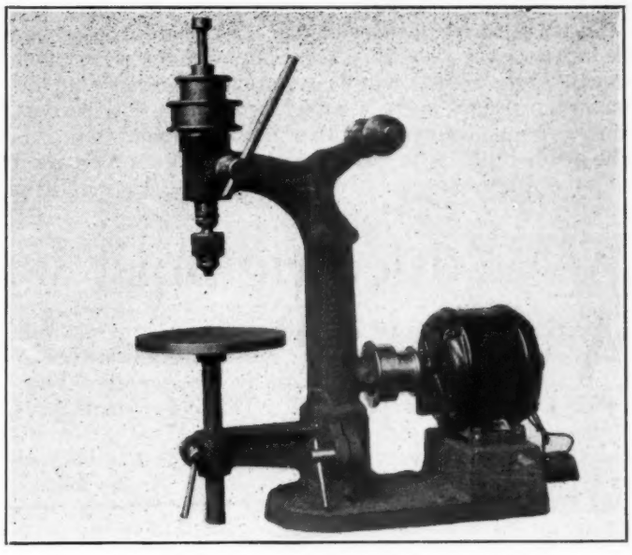
The capacity of the machine is for driving screws up to No. 14, 2½ in. long, in soft or solid wood. When suitable lead holes are provided, larger wood and lag screws up to 5/16 in. in diameter by 4 in. in length can be driven. These machines can also be used for setting up nuts to 3/8 in. in metal and wood. They are 15½ in. long and 3¾ in. in outside diameter. The no load speed of the spindle is 525 r.p.m. The net weight is 9½ lb.

Motor driven bench drill

WHEN the Buffalo Forge Company, Buffalo, N. Y., first put its Junior 10 in. bench drill on the market it was driven by a motor through a pinion and gear which resulted in a noisy operation. In order to overcome this defect, the machine has been redesigned with a ¼-hp., 1,750 r.p.m. motor with the belt drive pulleys keyed to the motor shaft. This gives a quiet, positive power transmission and also saves space. The spindle runs in a large bronze bushing, and is provided with a No. 2-A Jacobs chuck. Two speeds are provided and the shifting from one speed to the other is accomplished without using tools as the idler works with a snap socket.

The machine has a substantial cast iron frame and a finished circular table movable in both horizontal and vertical positions. The normal driving speed is 550 r.p.m., although it can be driven as high as 3,000 r.p.m. and still remain in balance.

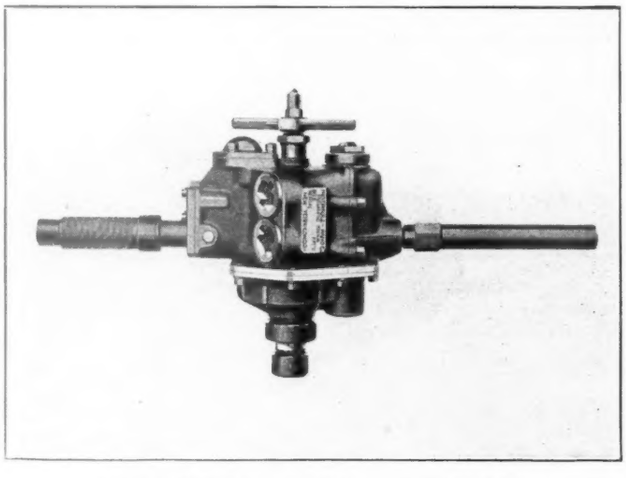
The height of the drill is 27½ in. with an 8-in. diameter table. It can drill holes up to ⅜ in. and to the center of a 10-in. circle. The travel of the spindle is 8½ in. and the greatest distance from the table to the spindle is 8 in. It also has a vertical movement of 3½ in. The net weight is 66 lb.



Buffalo Forge 10-in. Junior bench drill

Pneumatic drill provided with a speed governor

THE Ingersoll-Rand Company, New York, has recently added to its list of pneumatic tools a four cylinder pneumatic drill equipped with a speed governor to eliminate the racing of the machines when

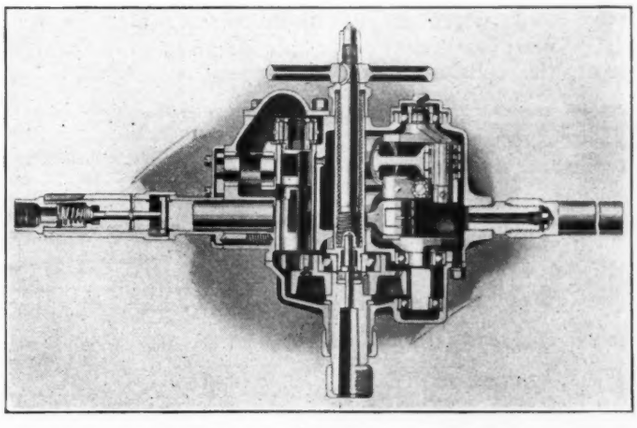


Ingersoll-Rand reversible pneumatic drill

running free. This governor is set so that the machine will do the maximum amount of work at the proper working speed. In addition to the governor, the valve mechanism consists of one valve of a gear timed construction. This valve is balanced at all times and there is, therefore, practically no wear on the valve or on the valve bushing.

All the cylinders have special steel liners, fitted into the steel casing, which are easily removed and renewed. With this construction, it is said to be practically impossible to dent the cylinder liner as the wall of the casing on the outside protects it, there being a chamber between the casing wall and the cylinder proper.

The crank pins are fitted with sleeves which are held stationary so that all of the wear takes place on the sleeve instead of the crank pin. Therefore, if a crank pin bearing becomes worn, instead of renewing the entire crank shaft, it is only necessary to renew the one sleeve. The crank pin bearings are lubricated from the inside of the crank pin out, instead of by revolving in a grease-filled crank case. It has been found that the centrifugal force of a high speed crank shaft throws the grease away to such an extent that the crank pin usually receives very little lubrication. With this method, the centrifugal force aids lubrication by throwing the grease from the inner



Sectional view of pneumatic drill equipped with a speed governor

part of the crank shaft out through the crank pin bearings.

A helical type of gearing is used for the crank pinion and the main driving gear. With this type of gearing, there are always two teeth engaged instead of only one as with the spur gear type. This considerably reduces the tooth pressure on the gears. The crank pinion is also

renewable. A new method of venting the casing through the crank shaft is used, which gives a better venting for the casing and still will not throw out the grease which is used to lubricate the machine.

The dead handle is screwed onto a stud which is set into the crank cap of the drill. This eliminates the wear which occurs when a dead handle is screwed directly into the crank cap proper as it is necessary to take out the dead handle frequently in order to properly lubricate the drill. The drill is fitted with a new type reversible throttle which has a rotating reverse throttle in addition to a poppet throttle. This is said to give excellent service and eliminate leaking. The throttle is fitted with a spring center with notches for the full forward speed, full reverse and dead center and is very easily regulated by the operator.

The crank parts can be completely assembled outside of the drill case and then inserted in the case. This feature saves time and assembling and assures the work being properly done. It avoids lost time from working on small parts if the crank has to be assembled in the case.

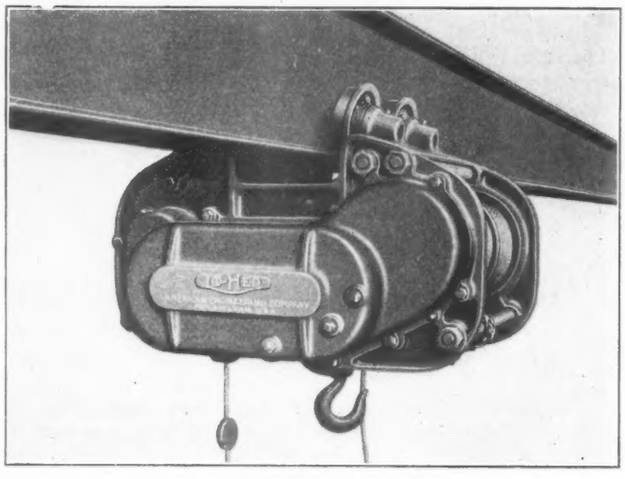
Electric hoist with low headroom

AN electric monorail hoist designed to operate in a minimum headroom has been placed on the market, in half-ton and one-ton sizes, by the American Engineering Company, Philadelphia, Pa. This hoist retains many of the features that distinguish the other "Lo-Hed" hoists made by the same company, but is smaller and is intended for general utility use where a light, handy electric hoist is needed.

Like all the "Lo-Hed" line, this hoist is able to draw the load hook up until it almost touches the rail, which makes it available for use in places where, because of low headroom, no other hoist could be used. It gives additional clearance and safety for bulky loads and makes it possible to pile materials higher than could be done by any other means, thus increasing the capacity of storage spaces by utilizing the space almost up to the ceiling.

Automatic holding and lowering brakes are provided and a safety device checks the hoist at the upper limit of travel and throws off the current. High duty roller bearings and automatic lubrication give a high efficiency. A factor of safety of five makes overloads possible in emergency.

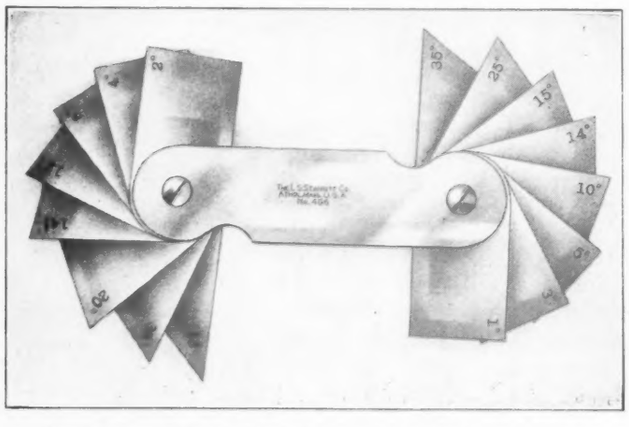
These hoists are furnished for either direct or alternating current. All working parts are completely accessible and the motor can be removed for repairs in a few minutes without touching the load on the hook.



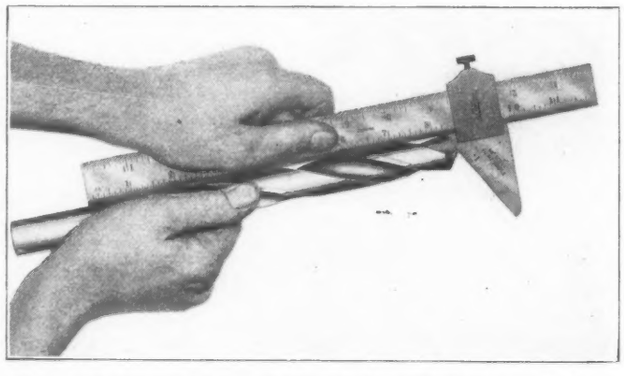
A view of the Lo-Hed Hoist showing gear and drum

Hand tools adaptable to railway shops

THE accompanying illustrations show four hand tools which are useful in the tool room or the machine shop. The angle gage contains 16 leaves, the ends of which are ground on an angle to degrees. The leaves are made from spring tempered steel and their two sides, as well as the angle edge, are ground. The gage embodies a combination of angles most frequently used, including 14½ deg., one-half the Acme Standard. The gage is about 9/32 in. thick, 11/16 in. wide and 4-3/16 in. long. It includes angles from 1 to 45 deg. It is especially useful to inspectors and toolmakers.



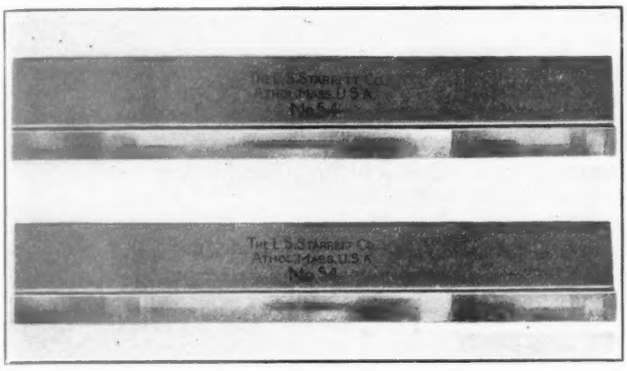
Angle gage No. 466 includes angles from 1 to 45 deg.



Drill point gage No. 22 designed for assisting in grinding drill points accurately.

The drill point gage has been designed for the specific purpose of assisting in grinding drill points accurately.

The method proposed for sharpening the cutting edges is to do one at a time. For satisfactory results, each lip must not only be the same length, but must also have the same angle in relation to the axis of the drill. Experience has determined that for ordinary drilling purposes a 59-deg. angle has advantages. When the lips or cutting



Tool steel, hardened and ground hold-downs

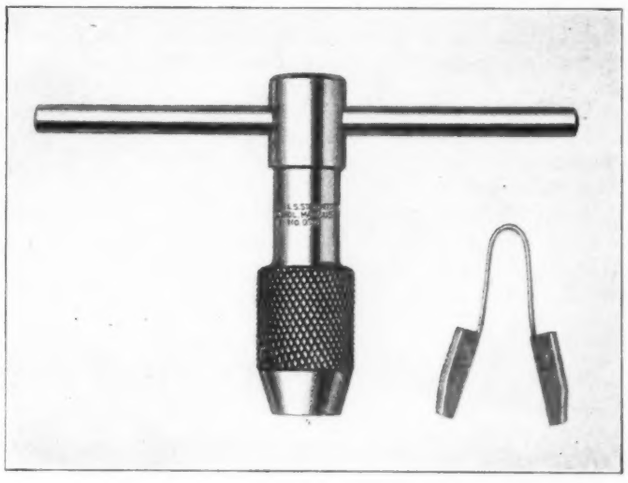
edges are the same, then it follows that the "dead center" will be located on the drill axis.

The use of this gage should effectively eliminate not only the breaking away of the cutting edges, splitting the drills and drilling oversize holes, but also break-downs from straining the machine bearings.

The blade furnished has sixty-fourth and thirty-second graduations on one side and sixteenths and eighths on the other. The angle part lies in the plane of the blade and, being adjustable, may be clamped to any point in its length. It may be also used as a square, depth gage, or book rule. The blade is 12 in. long.

The hold downs are used to hold work down flat as on a machine platen or in a vise where a small amount is removed from a surface, and where other methods of clamping are inconvenient. Work can be securely held without distortion. The contact edges are slightly tapered so as to force the base of the work to the bed of the machine. They are made of tool steel, hardened and ground.

The T-handle tap wrench is used for holding taps to be turned with the hand, and is also useful for holding drills, reamers and other small tools. The body is centered, enabling the workman to start the tap straight when using it on lathe centers or in an upright drilling machine. Its unique construction permits the jaws to conform to the



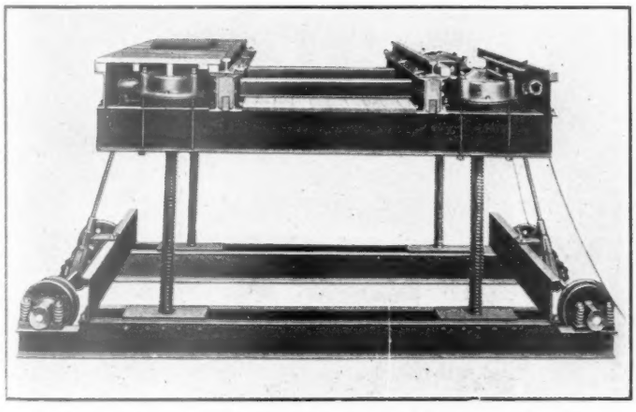
A T-handle tap wrench known as tool No. 93

piece to be held, making it rigid and less apt to become loose. The jaws and the knurled clamping nuts are heat-treated to withstand any ordinary use.

These tools are manufactured by the L. S. Starrett Company, Athol, Mass.

Whiting screw-type electric drop table

THE Whiting Corporation, Chicago, has developed a new screw-type electric drop table which may be designed to perform any dropping operation on wheels or other parts of locomotives or cars. Particular



Whiting self-contained electric drop table for enginehouses

advantages in the design of this drop table are safety, secured by the worm and gear type drive now used on over 100 Whiting hoists; ample, reliable power by means of electric motor drive; the absence of air or water lines, a feature of importance particularly in the northern states; and the provision in a single unit of a drop table for driving wheels and tender truck wheels.

The new drop table consists essentially of a truck with four stationary screws, the table being built on top. Wheels and axles are provided at each end of the truck, being inserted in roller bearings to permit easy lateral movement. The boxes are spring supported so that when the full locomotive weight is received, the springs will deflect. This in turn seats the screws on the rails, passing the weight directly onto the foundation of the pit track.

The table rails are reinforced and supported by beams. The load is carried to the driving units by means of transverse channels. The driving units consist of worms and worm wheels with roller thrust bearings. The latter are 14 in. in diameter and contain 56 rollers. The driving motor is mounted on the table, thus making it safe from flood. The control is a matter of choice but the push button type with extension cord gives the most flexibility.

The pit is rectangular in cross section and may be constructed straight or in conformity with the enginehouse circle. Channels are set in the wall to guide the table and insure its being correctly positioned. Sockets are pro-

vided for the power plug, from which a flexible cable leads to the hoisting motor.

In operation the power is turned on and the table run up until the locomotive weight is relieved from the locking bars. These bars are thrown out, a single lever performing the operation, and the table and load are then dropped to the low position. The entire unit is moved laterally by ratchets, the use of roller bearings making it possible to do this with one hand.

In dropping locomotive drivers, it is not necessary to take the locomotive weight on jacks before starting, as the new table has a capacity of 50 tons. Neither is it necessary to spot the locomotive closely as the entire rail section drops. As there are no heavy rail beams to be moved out of the way, one mechanic and a helper can do the work. In replacing the drivers with a drop pit, they are first lifted into position, the rail beams moved in place and a scaffold erected. With the drop table, the operator can stand in the table pit and come up with the drivers. The shoes can be placed first and held by shims. The pedestal binders can be set on blocks and fitted with wedges. In this way all the operations can be performed at once, saving time.

If the table is of sufficient length, two pairs of drivers or tender truck wheels can be dropped in a single operation. On the other hand, a single pair of tender wheels can be removed by just running them out on the table and blocking under the spring seat. Trailers may be handled, or a cradle casting can be blocked on the table and dropped without using extra blocks and tackle.

Boosters are readily removed on the drop table, a difficult operation on a drop-pit jack because of the shifting weight. This is due to the overhanging weight of the booster engine and the spring weight, which drops to zero after a few inches. The Whiting drop table has four legs and any shift of weight does not affect it. In addition, spring work is said to be done quickly and easily without disturbing any box packing. To renew a spring the table is raised two inches above the rail and the spring rigging blocked. The table is then dropped, taking the weight off the spring. It can then be readily removed. The same method can be employed in spring equalization.

Truck or trailer brasses also can be replaced readily. After blocking the box, the table can be dropped a few inches. On account of the self-locking worm drive, it is then safe to remove and replace a brass.

A self-contained centrifugal oil-extractor

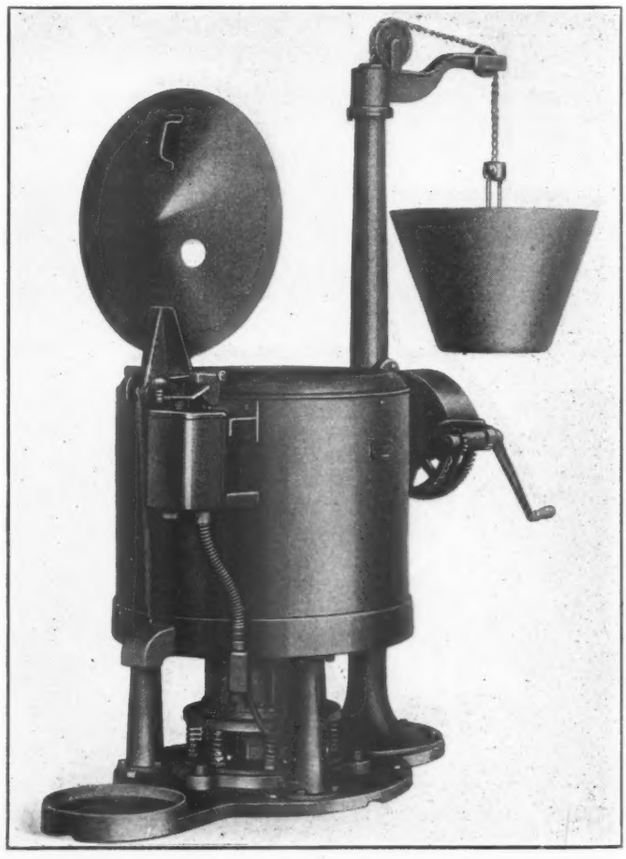
An entirely self-contained centrifugal oil-extractor electrically driven, eliminating belt, countershaft or motor stand, quarter turn pulleys, mechanical brake and rubber bumpers has recently been designed by the Curtis Machine Company, Worcester, Mass., and is being sold by the Crescent Washing Machine Company, New Rochelle, N. Y.

The motor is equipped with Timken bearings. The bearing at the lower end of the motor carries the radial loads only, while the upper bearing carries the radial loads and also the thrust load of the pan assembly, the spindle and the chip load. The weight of the entire assembly comprising the motor and pan is carried by a pivot bearing in the base of the machine. By means of a unique compensating feature in the application of the motor unit all vibration, common to this type of machinery, is transferred direct to the base of the machine.

The motor is of the squirrel cage type, specially designed to meet the requirements of this type of machine. It can be run on 220-volt, 440-volt or 550-volt, 60 cycle, three phase a.c. current. It has a speed of 1,165 r.p.m. and is mounted directly upon the spindle of the machine. The motor is controlled by a drum type controller conveniently mounted on the drum of the machine. The running or forward position is positive while the reverse side is spring actuated and is arranged for braking. The machine may be accelerated under full load in 10 seconds and stopped in 12 seconds.

An automatic safety lock is applied to the cover hinge. This device prevents the operation of the machine except when the cover is in the closed position, and at the same time prevents the splashing of oil.

The pan is filled with machine chips, or other material from which the oil is to be extracted, and then placed in position on the spindle by means of the hoist. The pan cover is then secured in place by means of the spindle nut and the machine run for from three to five minutes at a speed of 1,200 r.p.m. The resulting force acting upon the load is the equivalent of about 350 times gravity. The chips, being confined to the pan, are thus separated from the oil which leaves through various small openings between the pan and the cover and then finds its way to the spout in the base of the machine. For efficient handling the chips should first be gravity drained and an extra pan provided so that one may be loaded while the other is extracting.



An entirely self-contained oil extractor for removing oil from machine cuttings

General News

Locomotive and train cost statistics dispensed with

The Interstate Commerce Commission has amended its order relating to the compilation of monthly operating statistics, to annul the requirement of the reports of locomotive and train costs, selected accounts, except as to the reports to complete the twelve months of 1924.

Simultaneous application of M. C. B. couplers to all rolling stock in Japan

On some day in June, 1925, yet to be determined, the standard M. C. B. automatic coupler will be placed in service simultaneously on all the rolling stock of the Imperial Japanese Government Railways, replacing the manual type with side buffers now in use.

Wage statistics for September

The total number of employees reported by Class I railroads for the month of September, 1924, was 1,801,296, a decrease of 144,621, or 7.4 per cent as compared with the number reported for the same month of 1923, according to the Interstate Commerce Commission's monthly bulletin of wage statistics. The total compensation decreased $14,557,938 or 5.7 per cent. A comparison of the returns for the months of August and September, 1924, shows that in September the employment increased 0.7 per cent and the total compensation increased 0.5 per cent.

A. F. of L. condemns enginemen's brotherhood

The action of the chairman of the Brotherhood of Locomotive Engineers, in refusing to pay the union scale of wages in the brotherhood's mines in West Virginia and in replacing union miners with non-union workers, was condemned by the American Federation of Labor in resolutions adopted at the annual convention at El Paso, Tex., on November 22. The committee on resolutions reported to the convention that it had found there had been a strike in effect in four mines of the company in West Virginia since April 1, due to the failure of the company to renew a wage agreement; that the officers of the United Mine Workers of America had made repeated efforts to reach an agreement with the Brotherhood; that the miners and their families have been evicted from company houses and strike breakers have been employed.

In commenting on the adoption of the resolution, John L. Lewis, president of the Miners' Union, declared that "the refusal of the Coal River Collieries to deal with the United Mine Workers has been a scandal in the entire organized labor movement."

The convention also denounced the United States Railroad Labor Board and endorsed the Howell-Barkley railroad labor bill now pending in Congress.

Southern Pacific enginemen vote for strike

Although 90 per cent of the engine service employees on the Southern Pacific have voted in favor of a strike, there is little likelihood of such action being taken, at least for some time. William Sproule, president of the Southern Pacific, has made arrangements with the Brotherhood of Locomotive Engineers and the Brotherhood of Locomotive Firemen & Enginemen, representing the employees, to hold an early joint conference. The strike vote was taken as a result of the refusal of the management to renew direct negotiations with the brotherhoods on their request for general wage increases. The Southern Pacific was only one of the large number of western railways which participated in the dispute on the question before the Railroad Labor Board, but was picked out by the brotherhood executives as the road on which concerted efforts to secure acquiescence to their demands might best be made. The decision of the Labor Board which awarded a wage increase to the employees of 5 per cent on condition that they accept a number of changes in working rules apparently has not affected the situation on the Southern Pacific. Developments are being watched with great interest by the other roads involved in labor board decisions since the attitude of the brotherhoods toward the decision will be made known by the steps they take in the Southern Pacific case.

Higher wages will not necessitate higher rates

The Railroad Labor Board has denied the petition of the managers representing the Western Railways that the settlement made by the Southern Pacific with its enginemen and firemen be set aside. This petition averred that the proposed advance in wages would tend to necessitate general increases in freight rates. The board holds that there is no sufficient ground for this contention. The board considers only the increase on the Southern Pacific and compares only with that company's earnings. The board ignores the fact, presented by the managers, that the engine service brotherhoods had already gone to one other road with the demands that were made on the Southern Pacific; this as the first step in a campaign to have the Southern Pacific agreement apply generally to the western roads. The engine service brotherhoods were given until January 1 to agree to the provision of the Labor Board's decision in the case which ordered wage increases of six per cent, accompanied by changes in working rules which the brotherhoods violently opposed. There is no expectation among the western managements that this decision will receive any consideration whatever from the brotherhoods. If they ignore the decision, as is expected, the Board's finding provides that the same wage rates and working rules that have been in effect shall be continued.

A. R. A. to investigate power brakes

The American Railway Association has completed plans for a complete study and exhaustive investigation of power brakes and appliances for operating power brake systems. The investigation, the cost of which will be borne by the American Railway Association, will be conducted by Harley A. Johnson, assistant general manager of the Chicago Rapid Transit Railway, who, as director of research, will employ such assistants as may be necessary for conducting the work.

The American Railway Association, after conferences with the

LOCOMOTIVE REPAIR SITUATION

Date, 1924	No. locomotives on line	No. serviceable	No. stored serviceable	No. req. classified repairs	Per cent	No. req. running repairs	Per cent	Total req. repairs	Per cent
February 1	64,377	53,586	4,116	5,919	9.2	4,872	7.6	10,791	16.8
March 1	64,431	53,127	3,800	6,047	9.4	5,257	8.1	11,304	17.5
April 1	64,363	52,805	4,648	6,128	9.5	5,430	8.4	11,558	17.9
May 1	64,330	52,890	6,079	6,105	9.5	5,335	8.3	11,440	17.8
June 1	64,373	53,498	6,661	6,099	9.5	4,776	7.4	10,875	16.9
July 1	64,416	53,382	7,117	6,035	9.4	4,999	7.7	11,034	17.1
August 1	64,486	53,381	7,152	6,073	9.4	5,032	7.8	11,105	17.2
September 1	64,582	53,618	6,762	6,023	9.3	4,941	7.7	10,964	17.0
October 1	64,538	53,209	5,424	6,175	9.6	5,154	8.0	11,329	17.6
November 1	64,486	53,391	4,776	6,191	9.6	4,904	7.6	11,095	17.2
December 1	64,406	52,832	4,904	6,128	9.5	5,446	8.5	11,574	18.0

Data from Car Service Division reports.

director of the Bureau of Safety of the Interstate Commerce Commission, has agreed on the following plan:

1. Steps will be taken to obtain appliances, which, it is claimed, meet the views of the Interstate Commerce Commission, as indicated in its preliminary report and conclusions. If the plans or specifications for such appliances are available and the appliances are not yet being manufactured, steps will be taken by the director of research to secure such appliances, even to the extent of entering into an agreement to have such appliances made.

2. As soon as such appliances have been obtained they will be given exhaustive tests on the test rack at Purdue University, Lafayette, Indiana, which rack will be completely prepared and brought up to date for the purpose of this investigation.

3. Following the completion of the rack tests such devices will be given road tests, to develop whether or not they meet road conditions safely in service.

4. This program will be carried out with all dispatch and as promptly as the devices for these tests are available.

The investigation will also embrace such further study as may in the judgment of the director of research throw further light upon this problem.

Court news

EMPLOYERS' LIABILITY.—The Kentucky Court of Appeals holds that neither a machinist in defendant's roundhouse, injured while engaged in setting valves on engines nor the railroad was engaged in either interstate or intrastate commerce, so that the state Employers' Liability Act, which only applies when railroad and injured person are "engaged in commerce," was not applicable.—Idol v. L. & N. (Ky.) 261 S. W. 878.

WRONGFULLY DISCHARGED EMPLOYEE MUST MINIMIZE DAMAGE BY TRYING TO OBTAIN OTHER EMPLOYMENT.—The Mississippi Supreme Court holds that a servant engaged for a specified time and wrongfully discharged must make reasonable exertion to prevent loss by obtaining other employment, and if he enhances his damages by wilfully or negligently remaining out of employment the increased loss must fall on him.—Batesville-Southwestern v. Vick (Miss.) 90 So. 7.

AGREEMENT REQUIRING SHIPPER TO INSPECT CARS HELD INVALID.—The Louisiana Supreme Court holds that a clause in a bill of lading requiring the shipper to inspect the carrier's own cars and assume the risk of defects therein is invalid because (1) it requires the shipper to assume a risk arising from the carrier's own negligence in failing to inspect; (2) shifts the burden of proof to the shipper, and (3) requires an unskilled person to make an inspection which only an expert can make.—Coustaline v. L. R. & N. (La.) 98 So. 81.

EVIDENCE OF DEFECTIVE COUPLER.—The Federal Safety Appliance Act makes the duty to maintain couplers in such condition that they will always couple automatically by impact absolute, and the Mississippi Supreme Court holds that where plaintiff's testimony showed that because of the use of a nail instead of a cotter pin in the drawhead, a coupling could not always be made by the ordinary use of the lift lever, the nail catching on a part of the drawhead, there was sufficient evidence of a defective coupling appliance and a violation of the act, though it was not shown that the injured employee attempted to use the lift lever.—Yazoo & M. V. v. Cockerham (Miss.) 99 So. 14.

Ask extension of time for train control

Petitions for a postponement of the effective date of the Interstate Commerce Commission's order of June 13, 1922, as modified by its order of July 18, 1924, requiring installations of automatic train control, have been filed with the commission by the Lehigh Valley, the Cincinnati, New Orleans & Texas Pacific and the Southern.

In the petition of the C. N. O. & T. P., and the Southern, it is stated that 35.5 miles between Ludlow and Williamstown, Ky., have been equipped with the auto-manual type of inductive train control and that the equipment is now ready for inspection by the commission, and that this has been asked for; and that, until this installation and its performance under actual operating conditions have been inspected and observed by the commission's representatives and a report made, the petitioners hesitate to go forward on a major scale with the work of equipping the remaining mileage required by the order. Therefore, further time is asked in which to comply with the mandate of the order, and it is stated that if the present installation is approved the roads will proceed as rapidly as possible to equip the remaining mileage as required by the order.

The Lehigh Valley petition asks for a postponement of the effective date for six months. It says that a contract has been made with the General Railway Signal Company for the installation of the auto-manual system between Easton, Pa., and Newark, N. J., and that the full roadside equipment has been installed between Phillipsburg and Flemington Junction, N. J., over 20 miles, while ten locomotives have been equipped. This, the petition says, constitutes a bona fide effort to secure and install a device that will comply with the commission's order, and warrants additional time to complete the work.

The Delaware & Hudson Company has petitioned the commission to be exempted from the order of June 13, 1922, contending that its financial condition does not warrant such expenditures when other improvements are needed. The company says it has made serious efforts to install the automatic train control, but that its experiments to date do not justify such an expenditure as the commission contemplates. Experiments have been made with many systems of automatic train control on three miles of road, but the device needs further development.

The railroad further says it has ordered all material for the installation of automatic train control, beginning at Rouses Point, N. Y., and extending southward for one division. It declares that this will be installed and tested as soon as possible.

Labor Board decisions

INTERPRETATION OF INTERMITTENT SERVICE RULE.—A decision on questions raised in regard to the meaning and intent of the Intermittent Service Rule of Decision No. 630 has been made by the Railroad Labor Board. The rule in question reads as follows: "Where service is intermittent, 8 hours actual time on duty within a spread of 12 hours shall constitute a day's work. Employees filling such positions shall be paid overtime for all time actually on duty or held for duty in excess of 8 hours from the time required to report for duty to the time of release within 12 consecutive hours, and also for all time in excess of 12 consecutive hours computed continuously from the time first required to report until final release. Time shall be counted as continuous service in all cases where the interval of release does not exceed one hour." In answering questions raised in regard to the rule, the Labor Board decides that the meal period provided for in other rules of the decision cannot be considered as a part of the period of release under the Intermittent Service Rule. The board also decides that a carrier is within its rights in applying Rule 49 to a position or positions without first reaching an agreement with the representatives of the employees as to whether the rule is applicable, the employees if they disagree with the management to take up the matter in accordance with the provisions of the Transportation Act. In interpreting the language of the rule reading:

FREIGHT CAR REPAIR SITUATION

1924	Number freight cars on line	Cars awaiting repairs			Per cent of cars awaiting repairs
		Heavy	Light	Total	
January 1	2,279,363	118,653	39,522	158,175	6.9
February 1	2,269,230	115,831	45,738	161,569	7.1
March 1	2,262,254	119,505	49,277	168,782	7.5
April 1	2,274,750	125,932	46,815	172,747	7.6
May 1	2,271,638	131,609	47,666	179,275	7.9
June 1	2,280,295	138,536	50,683	189,219	8.3
July 1	2,279,826	144,912	49,957	194,869	8.5
August 1	2,278,773	153,725	49,139	202,864	8.9
September 1	2,296,589	158,200	51,909	210,109	9.2
October 1	2,304,020	157,455	48,589	206,044	8.9
November 1	2,313,316	150,703	39,840	190,543	8.2
December 1	2,304,676	146,286	42,854	189,140	8.2

Month	Cars repaired		
	Heavy	Light	Total
December	87,758	2,073,280	2,161,038
January	76,704	2,083,583	2,160,287
February	70,056	2,134,781	2,204,837
March	77,365	2,213,158	2,290,523
April	75,352	2,074,629	2,149,981
May	73,646	2,130,284	2,203,930
June	70,480	1,888,899	1,959,379
July	72,347	1,567,430	1,639,777
August	71,863	1,420,482	1,492,345
September	74,295	1,372,277	1,446,572
October	87,008	1,446,822	1,533,830
November	75,954	1,304,924	1,380,878

"Intermittent service is understood to mean service of a character where during the hours of assignment there is no work to be performed for periods of more than one hour's duration and service of the employees cannot otherwise be utilized," the board rules that whether the carrier is the sole judge as to whether or not there is work to be performed and if the service of the employees can otherwise be utilized shall be determined by the actual conditions in every case. The board rules also that it is not permissible to place an employee under the provisions of this rule by assigning his work to other employees so as to make it possible to allow him the period of release prescribed by the rule. Finally, the board rules that it is not permissible to place an employee on an intermittent service assignment where it can be shown that there is work to be performed during the period of release, even though the work can just as well be accomplished in a 12-hr. spread. An opinion dissenting from the decision of the board on the last two questions was rendered by Messrs. Elliott, Baker and Higgins, board members representing the railways.—Interpretation No. 3 to Decision No. 630.

Meetings and conventions

Mechanical division meeting in 1925

At a meeting of the General Committee, Division V—Mechanical A. R. A., held in New York, December 11, it was decided that the annual meeting of the Division for 1925 be a strictly business meeting, and that it be held in Chicago during the week commencing June 15.

It was decided at the meeting that the attendance at the Chicago meeting be restricted to the members of the General Committee of Division V, members of the various committees of Division V, and the voting representatives of the railway members of Division V, American Railway Association.

Later in the day of September 11, the General Committee of Division V met the Executive Committee of the Railway Supply Manufacturers' Association and announced the decision. J. J. Tatum, chairman of Division V, emphasized the fact that inasmuch as no exhibit of railway supplies and machinery would be held in 1925, it was to be hoped that in the following year a mechanical convention would be held with a larger and better exhibit than ever and a large attendance of railway supply men.

The following list gives names of secretaries, dates of next or regular meetings and places of meeting of mechanical associations and railroad clubs.

AIR-BRAKE ASSOCIATION.—F. M. Nellis, Room 3014, 165 Broadway, New York City. Next meeting May 5-8, Los Angeles, Cal.

AMERICAN RAILROAD MASTER TINNERS', COPPERSMITHS' AND PIPEFITTERS' ASSOCIATION.—C. Borcherdt, 202 North Hamlin ave., Chicago.

AMERICAN RAILWAY ASSOCIATION, DIVISION V.—MECHANICAL.—V. R. Hawthorne, 431 South Dearborn St., Chicago.

DIVISION V.—EQUIPMENT PAINTING DIVISION.—V. R. Hawthorne, Chicago. Business meeting to be held in Chicago during week commencing June 15. No exhibit of railway supplies and machinery will be held.

DIVISION VI.—PURCHASES AND STORES.—W. J. Farrell, 30 Vesey St., New York.

AMERICAN RAILWAY TOOL FOREMAN'S ASSOCIATION.—G. G. Macina, 11402 Calumet ave., Chicago.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.—Calvin W. Rice, 29 W. Thirty-ninth street, New York. Railroad Division, A. F. Steubing, Bradford Corp., 23 West Forty-third street, New York.

AMERICAN SOCIETY FOR STEEL TREATING.—W. H. Eiseman, 4600 Prospect Ave., Cleveland, Ohio.

AMERICAN SOCIETY FOR TESTING MATERIALS.—C. L. Warwick, 1315 Spruce St., Philadelphia, Pa.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS.—Joseph A. Andreucetti, C. & N. W., Room 411, C. & N. W. Station, Chicago, Ill.

CANADIAN RAILWAY CLUB.—C. R. Crook, 129 Charron St., Montreal, Que. Regular meetings second Tuesday in each month, except June, July and August, at Windsor Hotel, Montreal, Que.

CAR FOREMEN'S ASSOCIATION OF CHICAGO.—Aaron Kline, 626 N. Pine Ave., Chicago, Ill. Meeting second Monday in month, except June, July and August, Great Northern Hotel, Chicago, Ill.

CAR FOREMEN'S ASSOCIATION OF ST. LOUIS.—R. E. Giger, 721 North 23rd street, E. St. Louis, Ill. Meetings, first Tuesday in month, except June, July and August, at the American Hotel Annex, St. Louis.

CENTRAL RAILWAY CLUB.—H. D. Vought, 26 Cortlandt Street, New York, N. Y.

CHIEF INTERCHANGE CAR INSPECTORS' AND CAR FOREMEN'S ASSOCIATION.—A. S. Sternberg, Belt Railway, Clearing Station, Chicago

CINCINNATI RAILWAY CLUB.—W. C. Cooder, Union Central Building, Cincinnati, Ohio. Meetings second Tuesday, February, May, September and November.

CLEVELAND STEAM RAILWAY CLUB.—F. L. Frericks, 14416 Adler Ave., Cleveland, Ohio. Meeting first Monday each month at Hotel Cleveland, Public Square, Cleveland.

INTERNATIONAL RAILROAD MASTER BLACKSMITHS' ASSOCIATION.—W. J. Mayer, Michigan Central, 2347 Clark Ave., Detroit, Mich.

INTERNATIONAL RAILWAY FUEL ASSOCIATION.—J. B. Hutchinson, 6000 Michigan Ave., Chicago, Ill. Next annual convention May 26-29, Hotel Sherman, Chicago.

INTERNATIONAL RAILWAY GENERAL FOREMEN'S ASSOCIATION.—William Hall, 1061 W. Wabash St., Winona, Minn.

MASTER BOILER MAKERS' ASSOCIATION.—Harry D. Vought, 26 Cortlandt St., New York, N. Y. Next convention May 19-25, Hotel Sherman, Chicago.

NEW ENGLAND RAILROAD CLUB.—W. E. Cade, Jr., 683 Atlantic Ave., Boston, Mass. Regular meeting second Tuesday in month, except June, July, August and September, Copley-Plaza Hotel, Boston, Mass. Next meeting January 13. Paper on the Preservation of Forest Products will be read by Herman Von Schrenk, consulting timber engineer, New York Central.

NEW YORK RAILROAD CLUB.—H. D. Vought, 26 Cortlandt St., New York. Meeting third Friday of each month except June, July and August at 29 West Thirty-ninth St., New York.

NIAGARA FRONTIER CAR MEN'S ASSOCIATION.—George A. J. Hochgreb, 623 Brisbane Building, Buffalo, N. Y. Regular meetings, January, March, May, September and October.

PACIFIC RAILWAY CLUB.—W. S. Wollmer, 64 Pine St., San Francisco, Cal. Regular meetings second Thursday in month, alternately in San Francisco and Oakland, Cal.

RAILWAY CLUB OF GREENVILLE.—F. D. Castor, clerk, maintenance of way department, Bessemer & Lake Erie, Greenville, Pa. Meeting last Friday of each month, except June, July and August.

RAILWAY CLUB OF PITTSBURGH.—J. D. Conway, 515 Grandview Ave., Pittsburgh, Pa. Regular meeting fourth Thursday in month, except June, July and August. Fort Pitt Hotel, Pittsburgh, Pa.

ST. LOUIS RAILWAY CLUB.—B. W. Frauenthal, Union Station, St. Louis, Mo. Next meeting January 9. Paper on Railway Problems will be presented by Harvey Rubey, professor railway engineering, University of Missouri.

SOUTHEASTERN CARMEN'S INTERCHANGE ASSOCIATION.—J. E. Rubley, Southern railway shops, Atlanta, Ga. Next meeting January 13 and 14, Ansley Hotel, Atlanta, Ga.

TRAVELING ENGINEER'S ASSOCIATION.—W. O. Thompson, 1177 East Ninety-eighth St., Cleveland, Ohio. Annual meeting September, 1925, Chicago.

WESTERN RAILWAY CLUB.—Bruce V. Crandall, 189 West Madison St., Chicago. Meetings third Monday in each month, except June, July and August. Annual meeting May 23, Edgewater Beach Hotel, Chicago.

LOCOMOTIVES ORDERED, INSTALLED AND RETIRED

Month 1924	Installed during month	Retired during month	Aggregate tractive effort	Owned at end of month	Aggregate tractive effort	Building in R. R. shops
January	271	178	4,447,721	64,989	2,552,694,953	14
February	214	175	4,906,435	65,029	2,559,519,253	10
March	176	181	6,033,173	64,911	2,560,076,766	7
April	97	112	2,881,385	64,896	2,561,362,769	11
May	153	107	2,600,445	64,942	2,565,706,413	10
June	160	178	4,575,358	64,924	2,569,121,875	72
July	197	113	3,354,456	65,008	2,576,433,377	63
August	229	166	5,346,176	65,062	2,583,372,980	50
September	160	151	4,351,378	65,071	2,586,083,994	37
October	113	220	5,712,633	64,964	2,586,106,026	76
November	181	263	7,749,794	64,882	2,586,826,278	70
Total for 11 months	1,951	...	.....	.....	.....	..

Figures as to installations and retirements prepared by Car Service Division, A. R. A., published in Form C. S. 56A-1. Figures cover only those roads reporting to the Car Service Division. They include equipment received from builders and railroad shops. Figures of installations and retirements alike include also equipment rebuilt to an extent sufficiently so that under the accounting rules it must be retired and entered in the equipment statement as new equipment.

FREIGHT CARS ORDERED, INSTALLED AND RETIRED

Month 1924	Installed during month	Aggregate capacity tons	Retired during month	Aggregate capacity tons	Owned at end of month	Aggregate capacity tons	Building in R. R. shops
January	15,589	707,367	12,329	516,695	2,310,032	100,644,107	2417
February	11,386	554,481	10,466	411,228	2,310,570	100,767,731	2715
March	9,962	446,043	8,726	352,481	2,311,405	101,165,332	2697
April	8,718	369,978	8,026	306,288	2,312,074	101,223,891	2739
May	9,199	439,516	9,059	360,212	2,312,237	101,303,200	2467
June	10,909	538,118	8,347	321,094	2,314,798	101,569,593	2269
July	16,583	1,151,302	8,413	316,927	2,322,968	102,388,652	4602
August	15,452	785,288	8,834	333,173	2,329,582	102,845,000	3618
September	15,455	779,078	9,337	370,607	2,335,147	103,270,000	3045
October	16,598	834,762	10,504	218,806	2,342,149	103,688,000	2506
November	.....						
Total for 11 months	129,451						

Figures as to installations and retirements prepared by Car Service Division A. R. A. Figures cover only those roads reporting to the Car Service Division. They include equipment received from builders and railroad shops. Figures of installations and retirements alike include also equipment rebuilt to an extent sufficiently so that under the accounting rules it must be retired and entered in the equipment statement as new equipment.

Supply Trade Notes

The Link-Belt Company, Chicago, has moved its St. Louis office to 3638 Olive street.

B. B. Phillips has resigned as general manager of the Gifford-Wood Company, Hudson, N. Y.

M. T. Lothrop has been appointed vice-president of the Timken Roller Bearing Company, Canton, Ohio.

T. R. Talbot, manager of the St. Louis district of the Republic Iron & Steel Company, has resigned.

The Link-Belt Company, Chicago, has opened a warehouse and office at 5938 Linsdale avenue, Detroit, Mich.

The Pawling & Harnischfeger Company, Milwaukee, Wis., has changed its name to the Harnischfeger Corporation.

The Wine Railway Appliance Company, Toledo, Ohio, will construct a plant in that city to cost approximately $150,000.

The corporate name of the Zapon Leather Cloth Company, Wilmington, Del., has been changed to the Zapon Company.

The Mid-West Engineering Company, Chicago, has moved its sales office to the Steger building, 28 East Jackson boulevard.

Johns-Manville, Inc., will establish a plant in New Orleans, La., the first unit of which will be equipped and in operation by April.

Samuel Hale, formerly vice-president of the Interstate Iron & Steel Company, Chicago, died at Santa Fe, New Mex., on October 25.

Charles H. Bromly has been appointed manager of the lubrication and filtration division of S. F. Bowser & Co., Ft. Wayne, Ind.

C. J. Thompson, district sales manager of the Osgood Company, with headquarters at Chicago, has been transferred to New York.

The Joyce-Cridland Company, Dayton, Ohio, has opened an office in the Railway Exchange building, St. Louis, Mo., in charge of R. C. O'Brien.

The Chicago Varnish Works, Chicago, Ill., will in the future be operated under the name of E. I. du Pont de Nemours & Co.—Chicago Works.

The Cleveland Twist Drill Company, Cleveland, Ohio, plans the construction of one, two and four-story plant additions to its factory at Cleveland.

T. E. Beddoe has been appointed industrial sales engineer of the Cutler Hammer Manufacturing Company, with headquarters at Philadelphia, Pa.

J. B. Marks, purchasing agent of the Colorado Fuel & Iron Company, with headquarters at Denver, Colo., has also been appointed assistant to the president.

Benjamin P. Lane has been appointed local manager of the newly opened branch office and warehouse of the Sullivan Machinery Company at Los Angeles, Calif.

W. S. Campbell has been appointed manager of domestic machinery sales in the eastern district for Joseph T. Ryerson & Company, Inc., with headquarters at Jersey City, N. J.

J. F. Kroske has been appointed manager of pneumatic tool sales for the Ingersoll-Rand Company, in the Pittsburgh territory. Mr. Kroske's headquarters are at Pittsburgh, Pa.

The Linde Air Products Company has opened a branch office at Salt Lake City, Utah, in charge of R. L. Strobel and another office at Seattle, Wash., in charge of C. E. Rheim.

The Union Metal Products Company will expend $500,000 for the remodeling of its plant at Hammond, Ind., which it recently acquired from the Keith Railway Equipment Company.

D. E. Sawyer, formerly general sales manager of the Pollak Steel Company, New York, has been appointed vice-president of the Wanner Malleable Castings Company, Hammond, Ind.

Martin H. Schmid, metallurgical engineer of the United Alloy Steel Corporation, has been appointed assistant general manager of sales of the alloy division, with headquarters at Canton, Ohio.

P. Blair Lee, who has been engaged in special work for the vice-president and general manager of Birdsboro Steel Foundry & Machine Company, Birdsboro, Pa., has been appointed works manager.

The Southwark Foundry & Machine Company, Philadelphia, Pa., has discontinued its Cleveland office. This office is now located at 100 East South street, Akron, Ohio, in charge of F. H. Smith.

The Dallas office of the Franklin Railway Supply Company, under the supervision of S. D. Rosenfelt, district manager, have been moved to the Boatmen's Bank building, 314 North Broadway, St. Louis, Mo.

N. C. Failor Company, 30 Church street, New York, and G. A. Pabst, 106 South Jefferson street, Chicago, have been appointed direct sales representatives of the Stockbridge Machine Company in their respective territories.

C. S. Price, First National Bank building, Hazelton, Pa., has been appointed district representative for northeastern Pennsylvania of the Conveyors Corporation of America, Chicago. E. F. Elliott is associated with Mr. Price.

The Gibb Instrument Company, Bay City, Mich., has changed its name to the Gibb Welding Machine Company. The company is now engaged exclusively in the manufacture of electric welding and heating machines. There has been no change in organization.

Glen D. Evans, for many years connected with the J. F. Buhr Machine Tool Company, but more recently chief engineer of the Climax Engineering Company, at Los Angeles, Cal., has again joined the Buhr organization in the capacity of chief engineer.

T. R. Langan has been appointed manager, transportation division in the New York office of the Westinghouse Electric & Manufacturing Company to succeed A. J. Manson recently promoted to manager, heavy traction division of the railway sales department at East Pittsburgh, Pa.

The American Car & Foundry Company has sold to a Canadian syndicate its stockholdings in the Canadian Car & Foundry Company. It is understood that two or three Canadian men will replace the American Car & Foundry representatives who were elected to the directorate at the time of the stock purchase in 1920.

O. M. Bostwick, New York representative of the publicity department of the General Electric Company and formerly advertising manager of the Sprague Electric Works, has resigned. After a short vacation, it is expected that Mr. Bostwick will resume his activities in the technical publicity field in New York City.

The U. S. Metallic Packing Company, Philadelphia, Pa., has taken over the entire business of the Locomotive Lubricator Company, of Chicago, manufacturers of the Schlacks system of force feed lubrication. W. J. Schlacks, C. W. Rudolph and O. H. Neal, formerly of the Locomotive Lubricator Company, have become affiliated with the U. S. Metallic Packing Company.

The Milburn Sales Company, distributors in the Philadelphia territory for the Alexander Milburn Company, Baltimore, Md., makers of oxy-acetylene welding and cutting apparatus and portable carbide lights, has taken over the Metropolitan New York district with headquarters at 309 Fifth avenue. E. P. Boyer, D. Keyser and other assistants will be in charge of the New York City office.

E. A. Thornwell has been appointed representative of the Premier Staybolt Company, Pittsburgh, Pa., in the southeastern district, with headquarters in the Candler building, Atlanta, Ga., and E. B. Corbett has been appointed representative in the southwestern district, with headquarters at the corner of Sawyer and Winter streets, Houston, Tex. The company was previously without representation in these districts.

J. B. Odell, manager of the New York telephone distributing house of the Western Electric Company, New York, has been appointed assistant to the president of the company. Mr. Odell

has been in the service of the Western Electric Company since 1904. He served in 1909 as head of the equipment division of the telephone department at New York, and the following year became assistant manager. He later was manager at Richmond, Va., before becoming manager of the New York house.

The Hopp-Patterson Company has been organized under the laws of Illinois to engage in selling industrial equipment and supplies in Chicago. The organizers are J. H. Hopp, former vice-president of the Charles C. Kawin Company, and J. B. Patterson, district manager of the P. H. & F. M. Roots Company, Connersville, Ind. The equipment to be handled by the new company includes steam and centrifugal pumps, conveying and transmission equipment and air compressors.

A. A. Corey, Jr., president of the Vanadium Corporation of America, New York, announces that an arrangement has been made with the United States Ferro Alloys Corporation for the merging of that concern with the Vanadium company. The plan involves the acquisition of complete control of the operations and affairs of the Alloys company immediately, but the corporate organization will be maintained. Mr. Corey, president, and L. K. Diffenderfer, treasurer of the Vanadium Corporation have been elected also president and treasurer respectively of the United States Ferro Alloys Corporation.

A. H. Weston, sales engineer of the T. H. Symington Company, with headquarters at New York, has been elected vice-president in charge of sales of the Car Devices Company, with headquarters at Richmond, Va. Mr. Weston obtained his early mechanical training in the motive power department of the Baltimore & Ohio and the Western Maryland and was for several years mechanical engineer for the Atlantic Coast Line. He left railroad service to enter the employ of the T. H. Symington Company as mechanical engineer and for the past ten years has been sales engineer for the same company, with headquarters at New York.

Arthur J. Manson, manager of the transportation division, railway department, of the New York office of the Westinghouse Electrical & Manufacturing Company, has been appointed to the position of manager of the heavy traction division, railway department, at Pittsburgh, Pa., effective November 1. After graduating from the Massachusetts Institute of Technology in 1905, he entered the company's engineering apprentice course and assisted in the building and testing of the first electric locomotive for the New York, New Haven & Hartford. In the spring of 1907 he was assigned to the electrification work on this road and aided in the inauguration of the electric service. In this position he instructed the steam enginemen in their duties as electric enginemen. Mr. Manson was associated with the preliminary test conducted by the Pennsylvania Railroad on Long Island prior to the decision as to the system to be used in the Pennsylvania tunnels entering New York City. Later he became associated with F. H. Shepard, director of heavy traction, entering the New York office of the Westinghouse Company. He assisted Mr. Shepard in connection with the Pennsylvania contract for power house, substation and locomotives for the Pennsylvania New York tunnel electrification. In 1910 Mr. Manson entered the sales department of the New York office following construction, subway and elevated work. In 1920 he was made manager of the transportation division of the New York office which position he held at the time of his recent appointment. During the time when Mr. Manson was manager of the transportation division he wrote and published a book entitled Railway Electrification.

A. J. Manson

Trade Publications

THERMALOAD STARTERS.—Bulletin No. 106, descriptive of the thermaload starter for small alternating current motors, has been issued by the Monitor Controller Company, Baltimore, Md. An alternating current contractor combined with a thermal relay are the essential parts of this starter.

ELECTRIC EQUIPMENT FOR CRANES.—A 35-page bulletin, No. 48732, descriptive of electric equipment for cranes, has been issued by the General Electric Company, Schenectady, N. Y. Particular reference to crane motors and control, brakes, etc., is made and information is given on operating characteristics.

HAMMERS.—The Blacker "B" hammers, designed especially for tool dressing and general utility jobbing work, are described in an 8-page illustrated brochure issued by the Blacker Engineering Company, Inc., New York. The hammer travels over the anvil face performing hand forging and smithing operations without helpers.

ARCHES.—A 50-page catalogue showing the adaptability of its arches to all types of boilers and stokers, industrial furnaces and oil stills, has been issued by the M. H. Detrick Company, Chicago, Ill. The application of the Detrick sectional supported wall to pulverized fuel furnaces is described for the first time in this catalogue.

ELECTRIC TOOLS AND SHOP EQUIPMENT.—Drills, bench and pedestal grinders, tappers, screw drivers, socket wrenches, post and bench drill stands, etc., are among the electric tools and shop equipment illustrated and described in the attractive 32-page catalogue, No. 8, recently issued by the Black & Decker Manufacturing Company, Towson, Md.

BOLT HEADING MACHINE.—The Ajax Manufacturing Company, Cleveland, Ohio, has just issued bulletin No. 50, which is well illustrated and tells the complete story of the new heavy duty continuous motion heading machines for making bolts and rivets. This new machine contains some important improvements which should interest those who have anything to do with machinery of this type.

TURRET LATHES.—The No. 4 Universal turret lathe, which permits independent operation of two tool carrying units, the cross slide carriage and the hexagon turret slide and saddle, is fully described in a 12-page illustrated brochure issued by the Warner & Swasey Company, Cleveland, Ohio. Quick change of set-up from one job to another is provided and measuring, due to positive stops, is eliminated.

EXHAUST STEAM INJECTORS.—A 23-page illustrated booklet giving description and instructions for the installation and operation of the Elesco exhaust steam injector, has just been issued by the Superheater Company, New York. The theory and advantages of the injector are also briefly covered and test results from the New York, Ontario & Western and foreign roads are given on inserts in the back of the book.

SUPERHEATER DAMPERS.—An 8-page bulletin, No. 3, descriptive of superheater dampers, designed to regulate the flow of gases through the large flues when the throttle is open or closed, has been issued by the Superheater Company, New York. Cross-sectional drawings show the damper conditions with different link lengths, also the general arrangement of damper cylinder and rigging and method of pipe lagging for road locomotives.

EXPANSION BORING TOOLS AND REAMERS.—A complete description of the various types of expansion boring tools and reamers is given in catalogue No. 24, which contains 71 well illustrated pages and has just been issued by the Davis Boring Tool Company, St. Louis, Mo. The catalogue contains much valuable information pertaining to where and how to best apply these tools in order to obtain the maximum service from them. The last few pages contain illustrations showing all the various types of tools manufactured by this company and explains for what work they can be best adapted.

Personal Mention

General

C. W. Dysert has been appointed mechanical engineer of the Southern Pacific, Louisiana Lines, with headquarters at Houston, Tex., succeeding J. S. Netherwood.

R. L. Ettenger, formerly consulting mechanical engineer of the Southern, has been promoted to assistant vice-president, mechanical, with headquarters at Washington, D. C.

J. T. Leach, assistant master mechanic of the Eastern division of the Pennsylvania, has been promoted to master mechanic of the Wheeling division, succeeding P. M. Cheesman.

B. M. Swope, master mechanic of the St. Louis division of the Pennsylvania, with headquarters at Terre Haute, Ind., has been transferred to the Buffalo division, succeeding F. J. Huston.

P. M. Cheesman, master mechanic of the Wheeling division of the Pennsylvania, with headquarters at Mingo Junction, Ohio, has been transferred to the St. Louis division, succeeding B. M. Swope.

J. S. Netherwood, mechanical engineer of the Southern Pacific, Louisiana lines, has been promoted to assistant superintendent of motive power and equipment of the Louisiana lines, with headquarters at Algiers, La., succeeding B. M. Brown, whose promotion to chief assistant superintendent of motive power of the lines in Texas and Louisiana was reported in the December issue of the *Railway Mechanical Engineer*.

R. H. Bates has been appointed mechanical engineer of the Chicago Great Western, with headquarters at Oelwein, Iowa. He was born on June 11, 1889, at Altoona, Pa., and graduated from the Williamson Trade School in 1909, attending Northwestern University in 1921 and 1922. He entered railway service as a draftsman in the mechanical engineer's office of the Pennsylvania, with headquarters at Altoona, Pa., in August, 1909, and served in that position until September, 1911, when he was appointed draftsman on the Northern Pacific, with headquarters at St. Paul, Minn. He returned to the Pennsylvania as a draftsman, with headquarters at Ft. Wayne, Ind., in June, 1913, serving until October, 1917, when he entered the United States Army, serving in France from February, 1918, to March, 1919, with the Meteorological Division, Signal Corps. In May, 1919, he re-entered the service of the Pennsylvania lines west as chief draftsman, Northwest System, with headquarters at Pittsburgh, Pa., serving in that position until March, 1920, when he was promoted to motive power inspector, with headquarters at Chicago, which position he held until July, 1920. From September, 1920, to July, 1921, he served as senior mechanical engineer of the Interstate Commerce Commission, Bureau of Valuation, with headquarters at Chicago. He was employed as a car designer and checker of the American Car & Foundry Company, with headquarters at Chicago and New York, from March, 1922, to March, 1923, on the latter date being appointed chief draftsman of the Standard Stoker Company, which position he held until August, 1924, serving as acting mechanical engineer in charge of research and development work from January until June, 1924. On October 8, 1924, he was appointed to his present position as mechanical engineer of the Chicago Great Western, with headquarters at Oelwein, Iowa.

Master Mechanics and Road Foremen

M. A. Vaugh has been promoted to assistant road foreman of engines of the Cincinnati division of the Pennsylvania.

Vernon Hathaway has been promoted to assistant road foreman of engines of the Columbus division of the Pennsylvania.

J. McDonough, division master mechanic of the Atchison, Topeka & Santa Fe, with headquarters at Chicago, has retired.

G. R. Miller has been appointed master mechanic of the Slaton division of the Panhandle & Santa Fe, with headquarters at Slaton, Tex., succeeding W. W. Walker.

G. S. Emrich, assistant master mechanic of the C. & P. division of the Pennsylvania at Cleveland, Ohio, has been transferrred to Akron, Ohio, as assistant master mechanic of the Akron Division.

F. T. Huston, master mechanic of the Buffalo division of the Pennsylvania, with headquarters at Olean, N. Y., has been transferred to the Renovo division, with headquarters at Erie, Pa., succeeding J. B. Kapp, transferred.

John P. Morris, general foreman of the Atchison, Topeka & Santa Fe, at Shopton, Iowa, has been promoted to master mechanic of the Illinois division, with headquarters at Chicago, succeeding J. McDonough.

A. R. Sykes, assistant mechanical inspector of the Missouri Pacific, with headquarters at St. Louis, Mo., has been promoted to master mechanic of the newly created Little Rock division, with headquarters at McGehee, Ark.

E. A. Koschinske has been appointed superintendent of the locomotive shops of the Delaware, Lackawanna & Western at Scranton, Pa., succeeding J. R. Lancaster, resigned. Mr. Koschinske, who was born on February 21, 1888, at Scranton, entered the employ of the Delaware, Lackawanna & Western, in July, 1903.

W. W. Walker, master mechanic of the Slaton division of the Panhandle & Santa Fe, with headquarters at Slaton, Tex., has been transferred to the Pecos division of the Atchison, Topeka & Santa Fe, with headquarters at Clovis, New Mex., succeeding M. H. Haig, whose death was announced in the December issue of the *Railway Mechanical Engineer*.

Car Department

Harry Saunders has been promoted to car foreman of the Canadian National, with headquarters at Readville, succeeding A. Ludon, deceased.

J. A. Roberts has been appointed special inspector of the car department of the Chesapeake & Ohio, reporting to Paul Maddox, superintendent car department.

Shop and Enginehouse

E. C. Hanneman has been promoted to general foreman of the Atchison, Topeka & Santa Fe, with headquarters at Shopton, Iowa, succeeding J. P. Morris.

A. M. Semon, machine shop foreman of the Atchison, Topeka & Santa Fe at Chanute, Kan., has been promoted to assistant roundhouse foreman, with headquarters at Arkansas City, Kan.

A. B. Erickson, formerly gang foreman of the Chicago & Alton at Bloomington, Ill., has been appointed general foreman of the Missouri Pacific, with headquarters at Hoisington, Kan.

J. S. Ford, road foreman of engines of the Chicago, Burlington & Quincy, with headquarters at Aurora, Ill., has been promoted to assistant master mechanic of the Galesburg division, with headquarters at Galesburg, Ill., a newly created position.

P. A. Meyer, general foreman maintenance of equipment department of the Panhandle division of the Pennsylvania at Scully, Pa., has been appointed general foreman of the scrap dock and reclamation plant, Eastern division, with headquarters at Conway, Pa.

Purchasing and Stores

E. L. Cates has been appointed acting division storekeeper of the Minnesota division of the Northern Pacific, succeeding R. G. Becker.

J. C. Neph has been appointed assistant district storekeeper of the Eastern district of the Southern Pacific, with headquarters at El Paso, Tex.

John W. Cockrill has been appointed division storekeeper of the Illinois Central, with headquarters at Clinton, Ill., succeeding R. E. Downing, resigned.

A. L. Tucker, assistant general storekeeper of the Chicago & North Western, with headquarters at Chicago, has retired on pension after 45 years of service with the North Western.

R. G. Becker, division storekeeper of the Minnesota division of the Northern Pacific, with headquarters at Staples, Minn., has been transferred to the St. Paul division, with headquarters at St. Paul, Minn., succeeding W. L. Peabody, who has been assigned to reclamation work at Brainerd, Minn.